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UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
Bureau of Plant Industry, Soils, and Agricultural Engineering
and
PRODUCTION AND MARKETING ADMINISTRATION

[NOT FOR PUBLICATION]

MILLING, BAKING, AND CHEMICAL EXPERIMENTS WITH HARD RED SPRING WHEAT, 1947 CROP¹

by

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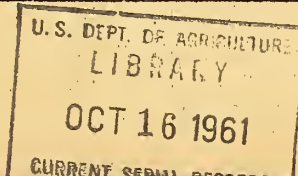
INTRODUCTION

Samples of the standard varieties and some of the new hybrid strains of hard red spring wheat, grown in cooperative experiments in the spring-wheat region ^{2/} of the United States, are milled each year by the United States Department of Agriculture and the flour baked into bread to determine their quality characteristics.

1/ Cooperative investigations of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, and the Grain Branch, Production and Marketing Administration. The samples were obtained from the cooperative experiments with the State Agricultural Experiment Stations in the spring wheat region.

2/ Clark, J. A. Results of spring wheat varieties grown in cooperative plot and nursery experiments in the spring-wheat region in 1947, with averages for 1938 to 1947. U. S. Dept. Agr., Agr. Res. Admin., Bur. Plant Indus., Soils, and Agr. Engin.; Div. Cereal Crops and Dis. 9200, 55 pp. January 1948. (Processed.)

Plant Industry Station
Beltsville, Md.
115 CC-September 1948.



The baking methods and techniques used on the 1947 crop were essentially the same as used in testing the wheat varieties and hybrid strains from the 1944, 1945, and 1946 crops. The bread-baking tests included one method that has been used also for the 1939 to 1943 samples inclusive (No. 6 baking test in the reports for those years).

The purpose of this report is to make available to cooperators the quality data from the 1947 crop obtained from standard varieties, new hybrid strains, and Federal supervision grade samples of hard red spring wheat, together with a summary of previous years' results.

SOURCE OF SAMPLES

Extensive tests were made on the Eastern and Western composite samples of each of seven uniform varieties and of many additional varieties and strains grown in plot experiments at cooperating stations. These included samples grown at Madison, Wis.; St. Paul, Waseca, Morris, and Crookston, Minn.; Fargo, Langdon, Edgeley, Williston, Minot, Mandan and Dickinson, N. Dak.; Brookings and Highmore, S. Dak.; Havre, Mont.; Sheridan, Wyo.; and Akron, Colo. Similar tests were made on Eastern and Western composites of the 26 strains grown in the Uniform Regional Nurseries; in the North Dakota Intrastate Nurseries; and from the Brookings, S. Dak.; Madison, Wis., Langdon, Mandan and Dickinson, N. Dak., station nurseries.

There were also included 18 samples composited from samples of carlot receipts of wheat accumulated during a 90-day period of the 1947 crop movement by the Minneapolis, Duluth, and Great Falls offices of the Grain Branch Production and Marketing Administration. These samples represent country-run wheat of the hard red spring class and included those only that were graded No. 3 or better under the provisions of the U. S. Grain Standards Act. These are hereafter referred to as commercial samples. This is the ninth season that such samples have been collected and tested.

METHODS USED IN THE MILLING AND BAKING TESTS

After the removal of dockage the samples were prepared for milling by the use of a milling separator and a scourer (both machines of experimental or laboratory size). The wheats were tempered in two stages; first to 14 percent of moisture for 48 hours and then additional amounts of water added 1/2 hour previous to milling, raising the moisture content of the grain to between 15.0 and 16.5 percent depending upon the hardness of the variety. The wheat was milled on an Allis-Chalmers experimental flour mill provided with three break rolls and one smooth roll. A 90 percent patent flour was made, discarding the low grade.

All test weights were determined in the laboratory on a dockage-free basis. The protein and ash contents are reported on a 14.0 percent moisture basis and the flour yield on a moisture-free basis.

The hardness of the grain was determined by pearling 20 grams of dockage-free whole wheat for 1 minute in a model No. 38 Strong-Scott Pearler. The amount of material pearled off expressed as a percentage of the wheat is called the pearling index. This pearling index has been found useful not only as a guide in tempering the samples for milling, but also as a measure of the vitreous character of the grain. A low index indicates hard grain and a high index soft grain.

EXPERIMENTAL RESULTS

The results for the regular methods on plot and nursery composite and station samples are given in tables 2 to 6, and for eight baking methods on the seven uniform varieties in table 7. The results for the commercial samples are shown in table 8, and the correlation and regression coefficients for 12 varieties and strains and the commercial samples are shown in table 9. Summaries of the comparable 1947 samples are averaged in table 10, and 10 year results in table 11. These tables are largely self-explanatory. The varieties or strains are arranged in the tables in order of their optimum loaf volume. The highest ranking variety or strain with respect to each property is indicated by underlining. Acre yields are included, where comparable, to assist in the interpretations of results.

Many varieties and selections from hybrids tested during recent years represent some of the newer material developed by plant breeders. In view of the general interest in them it seems desirable to present the data relating to them although the number of comparisons available for most of the selections is too small to allow very definite conclusions to be drawn. Based on these results, however, new wheats are advanced from station nurseries to the Intrastate and Regional nurseries and then to plots. Probably the most outstanding new strains tested for the first time are Pilot² x Merit N. 2174, from the Langdon station nursery, 1556 x 1563 N. 2156, from the Dickinson station nursery, and Pilot² x Thatcher N. 2030, from the Mandan station nursery, the results of which are given in table 6. Outstanding strains such as these are advanced to Intrastate and Regional nurseries.

Table 2.--Yield, milling, baking, and chemical results on the uniform varieties of spring wheat grown at experiment stations, from Eastern and Western composites of the 1947 crop and averages for 4 years.

Section and Variety	State or N.No.	C.I. No.	Acre Yield Bu.	Test Wt. Lbs.	Protein			Flour			Ab-sorp-tion Pct.	Mix-ing Time Min.	Opti-mum Bro-mate Wt.	Method and volume			Average			Pearling Index
					Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.	Yield Pct.	No. 6 best				Aver. 3 best	Opti-mum mm	Weight of loaf Grams	Crumb color	Grain-ture		
Eastern Composite 1/																				
Cadet		12053	25.8	57.6	13.4	13.2	74.1	.59	67	3.0	0	876	860	900	152	75	88	27.1		
Newhatch		12318	25.0	58.0	13.9	12.8	72.3	.50	67	3.0	0	868	857	898	154	93	93	28.4		
Regent		12070	25.1	58.7	13.7	12.8	74.2	.50	65	3.0	0	889	880	891	153	85	92	29.6		
Thatcher		10003	25.6	58.5	13.2	12.6	73.7	.48	65	3.0	0	778	815	882	150	83	87	25.8		
Mida		12008	28.7	60.6	13.6	12.5	76.8	.50	66	2.5	0	836	827	874	156	88	92	31.1		
Rival		11708	27.7	59.8	13.4	12.4	74.3	.52	67	3.0	0	763	789	851	154	88	90	28.9		
Pilot		11945	26.2	58.8	12.8	11.8	72.7	.45	64	2.5	0	755	780	818	153	87	88	25.5		
Average Range			26.3 3.7	58.9 3.0	13.4 1.1	12.6 1.4	74.0 4.5	.51 .14	66 3	2.9 0.5	0	824 134	830 100	873 82	153 6	86 18	90 6	28.1 5.6		
Western Composite 2/																				
Newhatch		12318	25.2	57.4	15.1	14.5	74.2	.64	67	2.5	0	919	919	968	153	85	88	31.1		
Thatcher		10003	27.7	58.6	14.6	14.0	73.1	.48	66	2.5	0	911	905	962	154	85	90	29.1		
Cadet		12053	26.0	56.7	14.7	14.2	73.1	.55	69	3.0	0	898	912	943	154	92	90	28.5		
Pilot		11945	27.0	57.7	14.0	12.9	71.7	.46	65	2.5	0	916	885	934	154	85	88	26.7		
Mida		12008	28.1	60.6	14.6	13.7	75.2	.50	65	2.0	0	830	843	888	152	90	92	33.0		
Marquis		3641	20.6	55.9	13.4	12.4	69.5	.48	65	3.0	0	821	815	859	154	78	88	30.0		
Ceres		6900	23.8	58.3	13.8	13.1	71.3	.47	68	3.0	0	833	821	850	156	82	90	25.6		
Average Range			25.5 7.5	57.9 4.7	14.2 1.7	13.5 2.1	72.6 5.7	.51 .18	66 4	2.6 1.0	0	875 98	871 104	915 118	154 4	85 14	89 4	29.1 7.4		
Average Eastern and Western Composites																				
Newhatch		12318	25.1	57.7	14.5	13.7	73.3	.57	67	2.8	0	894	887	933	154	89	91	29.8		
Cadet		12053	25.9	57.2	14.1	13.7	73.6	.57	68	3.0	0	887	886	922	153	84	89	27.8		
Thatcher		10003	26.7	58.6	13.9	13.3	73.4	.48	66	2.8	0	845	860	922	152	84	89	27.5		
Mida		12008	28.4	60.6	14.1	13.1	76.0	.50	66	2.3	0	833	835	881	154	89	91	32.1		
Pilot		11945	26.6	58.3	13.4	12.3	72.2	.46	65	2.5	0	836	833	876	154	86	88	26.1		
Average Range			26.5 3.3	58.4 3.4	13.8 1.1	13.1 1.4	73.3 3.8	.51 .11	66 3	2.8 0.7	0	859 61	860 54	907 57	154 2	86 5	90 3	28.6 6.0		

1/ From the Madison, St. Paul, Waseca, Morris, Crookston, Langdon, Fargo, Edgeley, Brookings, and Lincoln stations.

2/ From the Dickinson, Minot, Williston, Havre, Sheridan, North Platte, Alliance, and Akron stations.

Average 4 years, 1944 to 1947, inclusive

Section and Variety	Acre Yield		Test Wt. Lbs.	Protein		Flour		Absorption	Mixing Time	Optimum		Method and volume		Average		Grain-tex-ture	Score																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	Region	Com-posite		Wheat	Flour	Yield	Ash			No. 6	Cc.	Aver-3 best	Cc.	Opti-mum	Weight of loaf			Grams	Crumb color	Score																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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Table 3.--Yield, milling, baking, and chemical results for the leading hard red spring wheats grown in replicated "plots" in 1947.

Madison, Wisconsin

Variety or Cross	State or N.No.	C.I. No.	Acre Yield Bu.	Test Wt. Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Opti- mum Bro- mate	Method and volume		Weight of loaf	Average		Pearling Index	
					Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.				No.6 Cc.	Aver. 3 best num		Opti- mum Cc.	Crumb color		Grain- tex- ture
Regent		12070	29.3	57.4	12.1	11.1	71.8	50	65	2.0	1	784	752	784	152	73	88	26.5
Newhatch		12318	31.6	56.6	12.5	11.8	73.7	62	67	2.5	0	732	735	774	155	78	87	24.2
Pilot		11945	32.0	57.4	11.4	10.2	74.8	53	64	2.0	0	726	726	772	152	78	87	27.3
Thatcher		10003	30.9	57.3	11.3	10.5	74.8	63	65	2.5	0	720	714	752	150	75	82	22.9
Rival		11708	30.7	58.0	12.3	11.3	75.3	54	64	2.0	0	680	678	744	152	78	83	31.1
Cadet		12053	29.9	55.9	11.5	10.4	72.2	50	65	2.0	0	709	699	726	152	85	90	27.2
Mida		12008	32.1	58.9	11.5	10.5	74.9	55	65	2.0	0	690	675	715	155	82	83	30.4
Mida x Cadet	1831	12363	34.8	57.5	10.9	9.9	73.3	45	62	2.0	0	643	642	692	151	72	82	29.8
Henry		12265	33.0	57.2	10.3	9.0	73.0	45	62	2.0	1	686	662	686	152	68	83	37.5
Sturgeon		11703	34.1	58.8	12.2	10.6	69.3	47	62	2.0	0	594	614	677	151	80	78	37.9
Pilot x Mida	1756	12303	34.7	59.4	11.0	9.9	71.6	44	63	2.0	0	649	640	663	152	78	83	28.8
Average			32.1	57.7	11.5	10.5	73.2	52	64	2.1	0.2	692	686	726	152	77	84	29.4
Range			5.5	3.5	2.2	2.8	6.0	9	5	.5	1.0	190	138	121	5	17	12	15.0

St. Paul, Minnesota																		
Newhatch		12318	28.4	57.2	11.7	10.8	75.7	53	66	3.0	0	752	743	772	155	78	88	24.1
Regent		12070	27.2	55.7	11.6	10.7	72.1	50	64	2.5	0	752	747	764	153	78	87	26.0
Thatcher		10003	27.1	57.8	11.3	10.3	73.5	53	68	3.0	0	692	703	755	155	80	82	23.0
Cadet		12053	26.7	57.0	11.3	10.4	72.8	50	65	2.5	0	637	679	755	152	83	85	25.1
Pilot		11945	32.1	58.1	11.9	10.8	73.2	45	65	2.5	0	697	698	743	152	78	83	23.8
Redman		12496	30.2	56.5	11.2	10.5	74.6	47	65	2.5	0	726	725	738	152	82	86	28.8
Mida		12008	30.4	56.6	11.8	11.0	76.0	53	65	2.0	0	726	704	738	155	80	87	29.0
Premier x Timstein	11-39-59	12547	25.7	58.0	11.8	10.8	73.9	57	67	2.0	0	701	695	721	155	72	82	26.7
Hope x Timstein	11-39-46	12488	27.7	58.2	11.0	10.0	74.1	51	65	2.5	0	640	658	720	153	80	78	28.8
Rival		11708	28.5	58.2	11.3	10.3	74.6	55	67	3.0	1	699	658	699	159	80	78	20.1
Hope x Timstein	11-39-51	12546	31.9	59.3	11.1	10.2	74.9	53	67	2.5	0	668	664	698	156	80	80	25.3
Meritt x Thatcher	2104	12540	26.8	58.6	11.1	9.9	73.5	55	68	2.5	0	654	645	696	156	75	83	22.6
Meritt x Thatcher	11-36-67	12357	28.4	57.6	10.9	10.0	73.5	50	66	2.5	0	615	629	683	153	80	70	25.1
Henry		12265	20.6	56.4	10.5	9.4	74.0	43	62	2.0	0	621	625	643	154	68	72	31.3
Mida x Pilot	1756	12303	27.8	59.1	10.6	9.6	73.5	42	63	2.5	0	582	579	626	155	75	73	20.4
Average			28.5	57.8	11.3	10.3	74.0	51	65	2.5	0.1	677	677	717	154	78	81	26.4
Range			5.4	3.6	1.4	1.4	3.2	16	6	1.0	1.0	170	168	146	7	15	16	8.7

Table 3.—Continued

Waseca, Minnesota

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test Wt.	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Opti- mum Bro- mate	Method and volume		Average		Pearling Index		
					Wheat	Flour	Yield	Ash				No. 6	Aver. 3	Weight of loaf	Crumb color		Grain- tex- ture	Score
			Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Min.	Cc.	Cc.	Cc.	Grams	Score		
Regent		12070	25.1	58.8	13.6	12.9	73.9	.55	65	2.5	2	898	880	917	151	83	90	26.2
Newthatch		12318	24.8	59.1	14.1	13.3	74.3	.52	64	2.5	2	891	848	898	150	80	88	24.2
Thatcher		10003	24.7	58.8	13.9	13.1	74.4	.51	64	2.5	0	885	835	896	151	88	93	22.5
Hope x Timstein	II-39-46	12483	31.0	60.5	14.3	13.3	73.7	.53	67	2.5	0	881	877	885	151	90	90	27.7
Premier x Timstein	II-39-59	12547	29.0	60.4	14.3	13.1	71.6	.54	69	2.5	1	843	828	843	156	87	90	24.4
Cadet		12053	26.4	58.8	13.1	12.2	72.9	.55	65	2.5	1	839	827	839	153	90	93	23.5
Rival		11708	27.1	60.9	13.1	12.2	75.6	.56	65	2.5	0	783	794	824	152	83	95	25.4
Merc. x Thatcher	II-36-67	12357	28.6	60.5	12.9	12.1	75.0	.55	68	2.5	1	815	791	815	150	85	88	23.2
Hope x Timstein	II-39-51	12546	28.1	61.5	13.7	12.8	73.9	.57	68	2.5	1	809	805	809	154	93	92	24.7
Henry		12265	30.4	59.6	12.4	11.2	74.1	.48	60	2.0	0	787	788	806	150	82	85	30.3
Pilot		11945	25.9	59.6	12.5	11.2	71.7	.48	62	2.5	0	783	786	801	150	80	90	22.6
Mida		12008	28.2	61.6	13.1	12.0	76.2	.55	65	2.5	1	786	768	786	156	87	90	26.1
Mida x Pilot	1756	12303	31.0	62.0	13.0	12.0	73.7	.44	64	2.5	0	760	755	786	151	88	88	26.6
Merit ² x Thatcher	2104	12540	30.3	60.0	12.5	11.5	72.0	.56	68	3.0	1	758	728	758	153	88	85	20.0
Average			27.9	60.2	13.3	12.4	73.8	.53	65	2.5	0.7	823	811	833	152	85	90	24.8
Range			6.3	3.2	1.9	2.1	4.6	.13	9	1.0	2.0	140	157	150	6	25	10	10.3

Morris, Minnesota

Cadet		12053	36.6	59.8	12.9	12.3	73.7	.53	68	2.5	0	804	815	853	155	90	23.5
Regent		12070	30.8	59.7	12.9	12.3	74.5	.54	63	2.5	1	845	808	845	149	92	25.3
Newthatch		12318	30.5	59.8	13.2	12.9	75.5	.56	66	2.5	1	836	811	836	152	88	26.1
Redman		12496	36.6	61.0	12.8	12.1	76.2	.52	65	2.5	1	830	793	830	153	90	27.3
Thatcher		10003	35.0	61.2	12.5	12.0	74.6	.52	67	3.5	0	789	777	818	151	83	24.0
Henry		12265	33.5	61.5	12.2	11.3	76.2	.48	64	2.0	1	812	781	812	154	72	29.6
Hope x Timstein	II-39-46	12488	36.1	62.4	13.3	12.4	73.8	.48	67	2.5	0	792	771	812	157	85	28.4
Merc. x Thatcher	II-36-67	12357	35.4	60.7	12.9	11.9	76.4	.51	69	3.0	0	769	758	806	156	88	23.6
Premier x Timstein	II-39-59	12547	32.4	61.9	13.9	12.7	73.8	.57	67	2.0	1	803	766	803	158	88	26.0
Rival		11708	33.8	61.3	12.9	12.0	76.0	.56	67	2.5	0	760	759	801	154	88	24.3
Merit ² x Thatcher	2104	12540	35.4	61.6	12.5	11.7	74.3	.55	69	3.0	0	747	748	789	156	85	19.5
Pilot		11945	35.1	60.1	12.4	11.2	72.2	.46	63	2.5	0	741	741	781	152	82	22.5
Hope x Timstein	II-39-51	12546	38.6	61.8	12.9	12.3	75.2	.53	67	2.0	1	778	748	778	156	88	27.7
Mida x Pilot	1756	12303	38.7	62.9	12.5	11.4	75.8	.47	63	2.0	0	700	709	778	153	85	25.1
Mida		12008	33.8	62.4	13.0	12.1	76.3	.47	65	2.5	0	738	730	761	155	87	27.0
Average			35.2	61.2	12.7	12.0	75.0	.52	66	2.5	0.4	783	768	807	154	88	25.3
Range			8.2	3.1	1.7	1.5	4.2	.11	6	1.0	1.0	145	106	92	9	7	10.1

Table 3.--Continued

Crookston, Minnesota

Variety or Cross	State or N.No.	C.I. No.	Acre Yield	Test Wt.	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Opti- mum Pro- mate	Method and Volume		Average		Pearling Index		
					Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.				No. 6 Cc.	Aver. 3 best Cc.	Opti- mum Cc.	Weight of loaf Grams		Crumb color Score	Grain- tex- ture Score
Pilot		11945	30.7	55.0	16.0	14.8	70.2	.45	63	2.5	2	1067	1018	1074	148	83	88	27.6
Cadet		12053	30.1	54.1	15.9	15.3	70.9	.43	66	3.0	2	1009	995	1033	150	88	92	26.9
Newthatch		12318	29.7	54.1	15.8	15.1	73.3	.45	64	3.0	1	1041	998	1041	148	75	92	26.2
Thatcher		10003	29.1	55.0	15.4	14.8	73.2	.43	64	2.5	1	1024	1003	1024	148	85	90	25.5
Rival		11708	31.5	56.0	15.8	15.2	74.1	.48	66	3.0	2	1018	974	1024	150	80	87	28.2
Henry ²		12265	40.1	56.8	14.4	13.5	75.1	.45	62	2.5	1	1024	957	1024	149	72	88	35.9
Merit ² x Thatcher 2104		12540	35.1	56.4	15.1	14.4	72.3	.49	68	3.5	2	968	936	998	154	87	85	20.0
Regent		12070	31.9	54.5	15.2	14.9	73.1	.44	62	3.0	1	983	949	983	146	80	92	30.8
Premier x Timstein 11-39-59		12547	39.9	57.7	16.1	15.1	71.7	.44	68	2.5	1	962	926	962	156	88	92	27.5
Mida x Pilot 1756		12303	31.3	58.9	15.1	14.3	73.9	.39	62	2.0	2	934	905	960	150	90	90	35.7
Hope x Timstein 11-39-46		12488	38.0	58.2	16.2	15.1	72.1	.40	66	2.5	1	956	938	956	150	90	88	32.0
Redman		12496	31.2	55.8	14.4	13.8	73.7	.41	63	2.5	1	950	910	950	150	88	88	32.4
Mida		12008	37.8	59.4	15.3	14.6	75.7	.42	64	2.5	2	934	892	939	152	87	90	31.4
Merc. x Thatcher 11-36-67		12357	36.9	56.5	14.2	13.5	74.3	.43	66	3.0	2	937	916	937	152	83	87	24.5
Hope x Timstein 11-39-51		12546	44.8	59.7	15.3	14.5	74.4	.41	68	2.5	2	862	875	923	158	90	88	28.0
Average			34.5	56.5	15.3	14.6	73.2	.44	65	2.7	1.5	978	946	989	151	84	89	28.8
Range			15.1	5.6	2.0	1.8	5.5	.10	6	1.0	1.0	205	143	151	12	18	7	15.7

Brookings, S. Dakota

Newthatch		12318	17.6	58.2	15.2	14.6	73.3	.58	66	2.0	1	942	907	942	150	85	92	25.5
Regent		12070	17.3	57.7	14.6	13.8	70.3	.51	67	2.5	2	881	893	925	151	85	90	25.0
Cadet		12053	17.4	55.7	14.0	13.3	70.8	.55	67	2.5	2	876	856	881	152	85	93	23.1
Thatcher		10003	18.2	58.2	13.9	13.1	72.5	.52	64	2.5	1	873	859	873	148	82	90	23.5
Rival		11708	22.5	60.0	13.4	12.6	76.5	.59	67	2.5	0	795	817	865	152	80	88	23.2
Pilot		11945	22.2	57.5	13.7	12.9	71.5	.55	63	2.0	0	848	843	850	150	82	90	23.3
Mida		12008	23.0	59.3	13.3	12.7	74.3	.54	66	2.0	2	778	768	781	150	88	88	26.4
Average			19.4	58.1	14.0	13.3	73.4	.55	66	2.3	1.1	856	849	874	150	84	90	27.2
Range			5.2	4.3	1.9	1.9	6.2	.08	4	.5	2.0	164	139	161	4	8	5	3.1

Table 3.--Continued

Highmore, S. Dakota

Variety or Cross	State or N.No.	C.I. No.	Acre Yield Bu.	Test Wt. Lbs.	Protein		Flour		Ab- sorp- tion Time Min.	Mix- ing Bro- mate Mi.	Method and volume		Average		Pearling Index			
					Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.			No. 6 Cc.	Aver. 3 best Cc.	Weight of loaf Grams	Crumb color Score				
																Opti- mum Cc.	Opti- mum mum	
Regent		12070	30.3	59.2	13.6	13.1	74.9	.51	65	2.0	1	868	840	868	150	77	88	27.3
Cadet		12053	25.2	56.3	13.4	12.7	73.6	.56	68	2.0	0	766	784	830	154	78	87	22.5
Newhatch		12318	27.4	58.0	13.7	13.1	74.2	.54	68	2.5	0	786	783	809	154	78	83	25.8
Rival		11708	25.9	59.6	13.0	12.0	76.2	.55	68	2.5	0	729	751	809	154	83	87	25.0
Mida		12008	34.5	60.0	13.6	12.7	74.8	.48	66	2.0	0	752	753	789	155	85	85	27.6
Thatcher		10003	30.8	58.5	13.1	12.5	73.2	.49	67	2.5	0	755	756	784	152	75	83	24.5
Pilot		11945	31.8	58.5	13.0	11.9	73.1	.51	63	2.0	0	758	753	784	152	75	87	22.6
Average			29.4	58.6	13.3	12.6	74.3	.52	66	2.2	0.1	773	774	810	153	79	86	25.0
Range			8.6	3.7	.7	1.2	3.1	.08	5	0.5	1.0	139	89	84	5	10	5	5.1

Fargo, N. Dakota

Regent		12070	22.1	60.6	12.6	11.7	74.8	.56	63	2.0	1	789	765	789	75	90	24.9
Hope x Timstein	2776	12488	25.0	62.3	12.0	11.2	74.3	.51	69	2.5	0	669	699	772	88	83	26.4
C. x H.T.F.	1556	12263	24.3	61.6	11.4	10.5	74.1	.51	68	2.0	1	769	726	769	93	85	26.6
Redman		12496	23.7	60.1	11.8	11.0	75.4	.58	66	2.0	1	766	740	766	80	90	25.6
Thatcher		10003	22.7	60.7	12.5	11.6	73.9	.53	65	2.5	0	723	733	761	78	85	21.6
Rival x Thatcher	2280	12273	25.6	61.7	12.0	11.2	75.8	.52	64	2.5	0	666	688	752	80	85	25.4
Rival		11708	22.8	61.7	11.8	10.7	75.0	.57	67	2.5	0	626	646	738	82	78	26.6
Mida x Cadet	1831	12363	25.6	60.7	10.8	10.0	74.2	.49	64	2.5	1	735	700	735	77	87	24.6
Newhatch		12318	23.2	59.8	12.5	11.9	74.8	.52	65	2.5	1	732	722	732	78	88	22.2
1556 x 1563	1840	12431	23.8	60.3	11.1	10.1	73.3	.45	67	2.5	0	698	693	732	85	87	24.6
2744 x 2809	3261	12619	22.5	61.9	12.4	11.3	74.2	.48	68	2.0	0	680	675	732	88	83	26.9
Ceres		6900	22.5	61.3	11.5	10.4	73.4	.52	66	2.0	0	615	645	726	72	78	21.6
Cadet		12053	22.5	60.1	11.9	10.9	72.6	.56	68	2.5	0	712	705	721	87	87	22.2
2744 x 2809	3175	12440	22.6	62.0	12.1	11.2	73.6	.52	69	2.5	0	654	663	718	85	80	25.1
Pilot		11945	21.9	60.5	12.5	11.6	71.6	.52	63	2.0	0	623	650	715	80	82	22.5
Marquis		3641	22.6	61.8	11.1	10.2	69.6	.51	63	2.5	0	631	645	715	77	82	23.6
Pilot x 1514	2014	12476	20.6	62.4	11.8	10.7	73.1	.56	67	2.5	0	660	658	707	77	83	23.2
Merit x Thatcher	2104	12540	23.2	61.6	11.5	10.4	72.4	.55	69	3.0	0	655	666	706	90	85	19.3
Power		3697	22.1	60.9	11.6	10.7	72.9	.56	63	2.0	1	703	673	703	80	87	24.1
Henry		12265	26.4	61.2	10.4	9.5	76.5	.47	62	2.0	0	609	632	686	67	78	30.3
Pilot x Mida	1756	12303	25.0	62.6	10.9	9.8	74.8	.48	63	2.0	0	626	621	669	82	77	25.1
Premier		11940	21.9	61.7	12.1	11.2	73.9	.58	68	2.0	0	651	632	663	83	82	25.0
Mida		12008	23.2	62.1	11.9	10.8	76.0	.49	65	2.0	0	582	599	652	83	78	26.2
Average			23.3	61.3	11.7	10.8	73.9	.52	66	2.3	0.3	677	677	724	81	84	24.5
Range			5.8	2.8	2.2	2.4	6.9	.13	7	1.0	1.0	207	166	137	9	13	21.0

Table 3.--Continued

Langdon, N. Dakota

Variety or Cross	State or No.	C. I. No.	Acre Yield	Bu. Lbs.	Test Wt.	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Opti- mum Bro- mate	Method and volume			Average		Pearling Index
						Wheat	Flour	Yield	Ash				Aver. 3 best	Opti- mum	Grams	Weight of loaf	Crumb color	Grain- tex- ture
Rival		11708	40.0	61.0	15.1	14.5	78.0	.46	69	2.5	1	1027	953	1027	152	80	88	27.3
C. x H. T. F.	1556	12263	34.2	60.7	15.4	14.7	73.1	.42	68	2.5	2	989	1007	1021	154	93	88	30.0
Cadet		12053	30.2	57.1	15.8	15.3	74.0	.47	69	2.5	1	1015	930	1015	152	88	90	25.2
Pilot x 1514	2014	12540	34.3	61.8	15.5	14.4	74.0	.45	68	2.5	1	1004	934	1004	153	88	90	30.9
Hope x Timstein	2776	12488	39.3	61.4	15.5	15.8	73.9	.45	67	2.5	2	965	980	1003	152	90	88	26.7
Pilot		11945	29.0	58.3	15.4	14.4	72.3	.46	65	2.0	1	992	922	992	150	85	88	24.0
Redman		12496	31.7	58.7	15.0	14.7	74.4	.42	64	2.5	2	971	973	986	149	85	88	26.6
Regent		12070	29.5	59.0	15.1	14.6	75.1	.44	65	2.5	1	983	889	983	151	83	88	27.5
Mida		12008	37.5	56.6	15.2	14.7	74.8	.45	65	2.5	1	966	913	966	153	90	90	29.5
Newhatch		12318	30.5	56.6	15.2	14.7	74.8	.44	65	2.0	2	951	896	951	150	78	87	25.5
Mida x Cadet	1831	12363	34.7	59.7	14.7	14.0	75.2	.44	65	2.0	1	950	896	950	150	78	90	27.7
1691 x 1756	2105	12541	34.7	60.7	15.0	14.2	73.3	.39	66	2.0	1	948	905	948	152	92	90	27.0
Thatcher		10003	29.7	57.5	14.6	13.8	74.8	.43	64	2.0	1	925	933	939	150	82	90	23.9
Pilot x Mida	1756	12303	35.5	62.6	14.4	13.5	76.2	.38	64	2.0	1	899	853	899	153	87	87	29.3
Average			33.6	59.8	15.2	14.5	74.7	.44	66	2.3	1.4	970	927	977	152	86	89	27.4
Range			11.0	6.0	2.1	2.3	5.7	.09	5	0.5	2.0	128	154	128	5	14	3	7.0

Edgeley, N. Dakota

C. x H. T. F.	1556	12263	20.6	60.4	13.8	12.9	71.7	.52	68	2.0	0	827	836	865	156	93	93	28.2
Hope x Timstein	2776	12488	25.2	60.4	14.3	13.6	70.2	.56	68	2.5	1	865	835	865	156	90	90	29.4
Cadet		12053	21.1	58.4	14.0	13.4	72.4	.54	67	2.0	1	857	829	853	157	92	93	24.0
Pilot		11945	14.9	57.4	13.7	12.8	71.2	.54	63	2.5	0	801	803	851	150	83	88	22.8
Regent		12070	20.1	60.4	14.2	13.7	72.6	.50	66	2.5	2	845	845	847	152	85	87	27.6
Rival		11708	22.6	60.1	14.0	13.2	76.0	.62	68	3.0	0	781	765	824	154	82	88	25.1
Redman		12496	19.3	59.2	13.0	12.9	75.1	.56	66	2.5	0	781	787	821	154	83	90	26.6
Henry		12265	23.5	59.4	13.2	12.1	75.3	.59	64	2.0	0	784	774	798	153	73	85	29.9
Thatcher		10003	20.1	59.4	13.3	12.6	72.6	.50	66	2.5	0	738	749	789	154	82	88	24.0
Spinkoota		12499	22.1	61.4	14.0	13.4	72.6	.56	60	2.0	0	783	756	783	151	80	85	34.0
Newhatch		12318	18.8	59.0	14.0	12.6	74.2	.51	67	2.5	0	761	739	769	156	75	88	24.2
Rival x Thatcher	2280	12273	23.1	60.8	13.4	12.6	74.4	.56	67	3.0	0	683	703	764	156	80	82	24.8
Mida x Cadet	1831	12363	19.3	60.0	13.2	12.3	74.4	.52	66	2.5	2	760	743	761	155	80	85	26.8
Mida		12008	23.4	61.7	14.2	13.2	75.2	.52	65	2.0	2	663	645	668	154	85	78	26.8
Pilot x Mida	1756	12303	21.8	61.8	12.7	11.6	67.2	.44	65	2.0	1	640	632	640	156	88	80	26.1
Average			21.1	60.0	13.7	12.9	73.0	.54	66	2.4	0.6	769	763	793	154	83	87	26.7
Range			10.3	4.4	1.6	2.1	8.8	.18	8	1.0	2.0	202	213	225	7	20	15	10.0

Table 3.--Continued

Mandan, N. Dakota

Variety or Cross	State or N.No.	C.I. No.	Acre Yield	Test Wt.	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Opti- mum Bro- mate	Method and volume		Average		Grain- tex- ture	Pearling Index
			Bu.	Lbs.	Wheat	Flour	Pct.	Pct.	Pct.	Min.	Max.	No.6	Aver. 3	Weight of leaf	Crumb color	Score	value Pct.
Newthatch		12318	24.3	59.2	14.6	14.0	75.1	.56	63	2.0	1	883	841	151	78	92	29.7
C. x H. T. F.	1556	12263	23.9	60.0	14.6	13.6	71.7	.48	64	1.5	1	881	851	150	88	93	32.4
Regent		12070	18.9	59.4	13.9	13.2	72.8	.50	62	2.0	2	836	828	149	83	88	30.4
Pilot		11945	27.0	59.4	13.3	12.1	71.1	.49	61	1.5	1	830	809	149	80	90	26.5
Cadet		12053	23.9	59.0	13.6	13.0	75.3	.55	65	2.5	1	824	812	150	87	90	25.9
Thatcher		10003	25.3	60.3	13.4	12.7	73.8	.54	63	2.0	1	821	790	149	80	90	26.5
Mida		12008	22.9	61.1	14.4	13.4	73.0	.51	63	1.5	0	789	791	151	85	92	30.9
Rival x Thatcher	2280	12273	25.0	60.4	14.3	13.5	71.7	.52	62	2.0	0	783	779	151	82	92	32.2
Pilot x Mida	1756	12303	27.2	61.5	13.2	12.2	73.8	.50	63	2.0	0	732	704	150	85	88	27.1
Rival		11708	29.6	60.0	13.4	12.2	71.4	.54	65	2.0	0	729	737	152	83	88	26.6
Ceres		6900	22.3	59.2	12.5	11.7	71.3	.49	64	2.0	1	760	748	151	75	87	23.5
Marquis		3641	20.9	57.0	11.7	10.9	70.1	.54	61	1.5	0	726	725	148	68	82	23.0
Average			24.3	59.7	13.6	12.7	72.6	.52	63	1.9	0.7	800	785	150	81	89	27.9
Range			10.7	4.5	2.9	3.1	5.2	.08	4	0.5	2.0	157	147	4	20	11	9.4

Dickinson, N. Dakota

Regent x Mida	1843.41	12542	23.3	61.3	15.5	14.9	72.9	.49	64	2.0	2	885	867	151	83	90	31.1
Cadet		12053	25.3	58.8	14.8	14.3	71.5	.51	67	2.0	1	873	830	152	90	93	26.1
Regent		11869	21.3	59.5	14.9	14.3	72.8	.54	64	2.0	1	868	861	150	88	92	28.5
Mida		12008	24.3	62.2	15.3	14.3	73.0	.49	64	2.0	1	859	823	154	93	90	30.7
Rescue		12436	25.4	59.2	14.2	13.8	72.2	.47	63	2.0	0	827	826	149	78	88	30.7
Newthatch		12318	23.6	58.4	15.5	14.8	71.7	.51	64	2.0	1	836	828	151	87	90	26.1
Thatcher		10003	26.2	59.7	14.1	13.5	71.9	.49	65	2.0	0	809	802	150	80	87	24.6
Regent x Pilot	1753	12317	28.8	60.2	14.5	13.4	68.1	.44	64	2.0	0	799	778	150	85	87	25.7
Rival		11708	27.6	60.9	14.7	13.7	73.3	.52	66	2.0	0	801	790	152	90	88	26.7
Ceres		6900	19.6	58.8	14.1	13.4	70.3	.53	64	2.5	1	795	760	151	73	90	25.0
Pilot		11945	25.6	59.7	14.2	13.1	71.4	.44	63	2.0	1	789	777	151	83	88	25.6
C. x H. T. F.	1556	12263	24.5	60.5	14.9	13.9	69.1	.46	64	1.5	1	787	749	151	87	83	29.2
Mida x Cadet	1831	12363	32.6	61.0	13.8	13.0	72.9	.45	63	2.0	1	786	778	151	85	92	28.5
1552 x Mida	1924	12482	34.0	61.5	14.1	13.0	71.8	.46	64	2.0	0	766	759	150	85	90	30.0
Marquis		3641	16.7	54.1	13.2	12.5	67.6	.51	63	3.0	1	763	747	150	77	87	26.3
Vesta		11712	22.8	61.2	13.8	13.2	74.5	.47	64	3.0	0	723	732	153	87	85	27.5
Pilot x Merit	2012	12493	30.3	60.0	15.0	13.8	68.7	.46	66	2.5	1	752	732	153	87	83	22.0
Pilot x Mida	1756	12303	27.8	61.9	14.0	13.1	70.6	.39	63	2.0	0	687	688	152	90	85	29.2
Average			25.5	59.9	14.5	13.7	71.4	.48	64	2.1	0.7	800	785	151	85	88	27.4
Range			17.3	8.1	2.3	2.4	6.9	.15	4	1.5	2.0	198	179	5	20	10	9.1

Table 3.--Continued

Minot, N. Dakota

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test Wt.	Protein		Flour		Ab- sorp tion	Mix- ing Time	Opti- mum Bro- mate	Method and volume		Average		Pearling Index		
					Wheat	Flour	Yield	Ash				No. 6	Aver. 3	Opti- mum	Weight of loaf		Crumb color	Grain- tex- ture
Cadet C. x H. T. F. Thatcher Newthatch Rescue Regent Pilot Henry Redman Mida Pilot x Mida Rival Ceres Vesta	1556	12053 12263 10003 12318 12436 11869 11945 12265 12496 12008 12303 11708 6900 11712	27.6 32.7 32.4 28.9 29.2 34.0 26.7 38.1 34.5 34.0 33.9 37.3 30.8 32.2	55.5 59.2 57.3 55.5 55.9 58.4 55.7 58.0 57.0 60.8 60.3 59.0 57.6 57.4	15.3 14.6 14.8 15.6 14.9 14.5 14.7 14.1 14.4 14.9 14.0 14.2 14.3	14.4 13.6 14.1 14.7 14.0 13.9 13.7 13.1 14.0 13.8 13.2 13.3 13.3	73.6 72.3 74.5 75.3 72.5 73.2 72.3 74.2 74.6 75.4 75.5 74.9 72.4 76.0	.49 .48 .41 .50 .45 .43 .43 .46 .46 .44 .44 .44 .45 .45	68 69 65 66 62 65 64 63 66 65 63 66 64	2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.0 2.5 3.5	1 1 1 1 1 1 1 1 1 1 1 0 0	931 913 911 909 906 905 894 874 868 865 848 818 795	895 850 847 883 872 858 834 837 820 827 797 799 802 761	931 912 911 909 906 905 894 874 868 865 848 830 798	153 155 150 149 149 151 148 151 152 150 153 152 149	87 90 78 77 77 85 78 70 75 88 88 70 82	92 90 90 92 90 90 90 83 87 88 90 90 87	27.4 30.4 27.9 27.1 30.9 29.0 25.2 34.6 29.6 30.0 31.2 26.8 22.9 27.2
Average Range			32.3 11.4	57.7 5.3	14.6 1.6	13.8 1.6	74.1 3.7	.45 .09	65 7	2.5 1.5	0.9 1	879 136	834 134	880 133	151 6	81 20	89 9	28.6 11.7

Williston, N. Dakota

Pilot Cadet Regent Ceres Thatcher C. x H. T. F. Rescue Newthatch Mida x Cadet Rival Mida Vesta	1556	11945 12053 12070 6900 10003 12263 12435 12318 12363 11708 12008 11712	38.9 39.0 38.5 39.0 40.9 35.5 35.8 39.6 42.2 40.0 39.6 37.0	54.0 54.3 57.0 57.0 55.9 57.0 55.9 55.0 58.4 56.6 59.7 56.1	15.6 16.4 15.6 15.1 15.4 15.5 15.4 16.2 14.7 15.1 15.2 15.1	14.4 15.7 14.8 14.6 14.6 14.9 14.3 15.2 13.7 14.0 14.2 14.1	71.6 70.2 73.1 71.8 71.7 71.2 71.2 72.5 74.8 74.0 75.9 72.2	.50 .51 .45 .51 .46 .47 .46 .51 .45 .50 .45 .50	62 68 67 66 66 62 66 65 63 66 63 66	2.0 2.5 2.5 2.5 2.5 2.5 2.5 2.0 2.0 2.5 2.0 3.5	1 1 1 0 0 0 1 0 1 1 0 1	948 943 922 865 848 870 853 853 854 851 821 818	920 922 922 863 866 852 853 846 823 830 819 801	948 943 922 899 897 897 870 862 854 851 830 818	149 152 153 151 151 148 152 152 153 151 150 152	83 88 83 78 83 78 90 88 82 85 90 88	88 90 90 87 88 90 92 87 90 90 90 88	25.4 26.2 30.9 24.8 27.3 30.3 30.9 29.6 30.3 28.6 32.0 25.3
Average Range			39.2 6.4	56.4 5.7	15.4 1.7	14.5 2.0	72.5 5.7	.48 .07	65 6	2.4 1.5	0.6 1.0	871 130	859 121	882 130	151 5	84 12	89 5	28.5 6.7

Table 3.--Continued

Havre, Montana

Variety or Cross	State or N.No.	C.I. No.	Acre Yield Bu.	Test Wt. Lbs.	Protein		Flour		Ab- sorp- tion Time	Mix- ing Time	Opti- mum Bro- mate		Method and volume		Average		Pearling Index
					Wheat	Flour	Pct.	Pct.			No.6	Aver. 3 best	Opti- mum	Weight of loaf Grams	Crumb color	Grain- tex- ture Score	
Thatcher	(tall)	12628	17.3	52.7	17.3	17.1	72.7	.49	65	2.5	2	1043	1041	1084	80	83	30.6
Mida x Cadet	1831	12363	15.2	53.9	17.0	16.2	72.9	.50	69	3.0	1	1070	1036	1070	83	85	25.3
Pilot		11945	16.3	53.1	18.0	17.1	70.5	.52	64	2.5	1	1063	1048	1063	82	83	23.6
Ceres		6900	16.5	56.7	17.3	16.7	72.2	.50	66	2.5	2	986	991	1055	78	83	24.0
Mida x Cadet	1752	12321	15.8	53.4	17.3	16.5	73.7	.50	66	2.5	2	1029	1019	1039	78	87	25.8
Marquis		3641	14.8	57.4	17.7	16.8	70.7	.48	64	2.0	2	1030	1014	1039	90	88	28.5
Thatcher		10003	15.8	54.6	17.9	17.3	71.5	.50	64	2.0	1	1038	1004	1038	85	83	27.2
Rescue		12435	14.8	55.0	17.9	17.5	71.5	.50	65	2.5	2	1034	1019	1036	83	80	28.5
Cadet		12053	16.5	51.3	18.3	17.7	70.3	.55	68	3.0	2	1015	1012	1030	83	80	24.4
Merit x Pilot	1860	12355	15.8	55.0	17.3	16.8	70.7	.62	70	2.0	3	901	966	1012	82	83	25.2
Pilot x Mida	1756	12303	16.7	56.6	16.7	15.9	72.7	.47	66	2.5	1	1003	977	1003	90	87	25.8
Newhatch		12318	15.0	53.9	18.0	17.2	72.3	.56	65	2.0	2	908	949	1001	77	85	27.7
Mida		12006	13.7	56.3	16.6	15.9	74.9	.56	68	3.0	2	922	922	945	82	85	27.4
Average			15.7	54.6	17.5	16.8	72.0	.52	66	2.5	1.8	1003	1000	1031	83	84	26.5
Range			3.6	6.1	1.7	1.8	3.4	.15	6	1.0	2.0	162	126	139	13	8	6.6

Akron, Colorado

Mida x Cadet	1831	12363	19.0	57.7	12.0	11.4	74.2	.57	68	2.5	2	806	787	824	83	87	25.3
Thatcher		10003	18.8	56.8	12.9	12.2	72.0	.54	63	2.5	1	815	783	815	80	85	25.6
Pilot		11945	16.5	56.2	12.0	11.0	71.6	.54	62	2.5	1	803	780	803	85	88	23.7
Cadet		12053	15.6	56.1	12.1	11.5	72.2	.56	68	2.5	1	798	776	798	85	88	26.1
Reward		8182	17.7	61.9	13.1	12.1	71.8	.50	62	2.5	1	798	771	798	88	90	29.6
Regent x Pilot	1952	12475	13.4	57.8	12.7	11.9	71.4	.61	68	3.0	2	766	750	792	83	85	20.7
C. x H. T. F.	1556	12263	19.7	59.2	12.3	11.6	75.5	.53	65	2.0	2	772	758	789	85	85	30.3
Newhatch		12318	17.6	56.4	13.2	12.6	73.4	.56	64	2.5	0	784	784	786	83	90	27.5
Pilot x Mida	1756	12303	17.0	58.0	12.0	11.4	69.8	.59	69	3.5	2	744	699	755	78	82	22.8
Mida		12008	21.3	60.2	11.6	10.7	74.5	.56	63	2.5	1	747	710	747	82	85	27.8
Marquis		3641	15.1	55.0	11.5	10.8	67.6	.55	63	2.5	1	735	719	735	78	83	23.0
Pilot x Merit	1898	12442	19.0	59.2	11.9	11.1	70.8	.54	68	3.0	2	726	678	726	80	80	23.0
Merit x Pilot	1764	12315	20.8	60.0	11.1	10.5	73.9	.53	65	2.0	1	720	708	720	80	83	26.3
Ceres		6900	15.7	59.3	11.2	10.2	69.3	.53	66	2.5	0	698	692	720	77	85	22.6
Converse		4141	17.1	57.1	10.1	8.9	68.2	.44	56	2.5	2	695	664	706	80	82	39.9
Average			17.6	58.1	12.0	11.2	71.8	.54	65	2.6	1.3	760	737	768	82	85	26.3
Range			7.9	5.8	3.1	2.4	7.9	.17	13	1.5	2.0	120	123	118	11	10	19.2

Table 3.—Continued

Sheridan, Wyoming

Variety or Cross	State or N.No.	C.I. No.	Acre Yield Bu.	Test Wt. Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Opti- mum Bro- mate	Method and Aver.		Average Crumb		Grain- tex- ture	Pearling Index	
					Wheat	Flour	Yield	Ash				No. 6	3 best	Opti- mum	Weight of loaf	color	Score	value
Regent x 1582	1912	12446	30.4	56.7	15.1	14.4	72.4	.51	64	2.0	2	942	931	974	148	82	87	28.8
Regent x Mida	1952	12475	30.6	56.6	14.4	13.3	70.2	.50	65	2.5	1	933	904	933	148	82	87	23.7
Newhatch		12318	33.6	57.0	16.1	15.3	74.4	.53	65	2.0	1	919	891	919	150	82	90	28.6
Ceres		6900	31.3	58.6	15.3	14.5	73.0	.52	68	2.5	0	901	879	916	153	78	90	24.0
Rival x Thatcher	2280	12273	41.4	59.2	15.7	14.6	72.8	.44	64	2.0	1	915	891	915	146	85	90	30.8
Thatcher		10003	71.0	57.4	15.4	14.6	74.0	.47	64	2.0	1	906	879	906	147	82	90	32.0
1750 x 1753	2095	12551	32.9	59.6	15.6	14.2	70.5	.49	67	2.0	1	893	863	893	152	92	92	24.9
Mida		12008	37.4	60.0	15.5	14.4	74.0	.52	65	2.0	0	885	836	892	150	87	92	29.5
Marquis		3641	33.0	57.0	15.3	14.3	72.3	.52	64	2.0	0	885	864	889	150	90	90	29.2
Pilot x Merit	1898	12442	36.7	56.5	15.1	14.0	72.9	.55	68	3.0	1	889	860	889	151	92	92	26.2
C x H-Turkey-Flcr.	1556	12263	36.5	58.1	15.6	14.4	70.8	.49	67	2.0	1	885	878	885	150	95	93	30.4
Cadet		12053	35.0	55.4	15.0	14.1	72.8	.54	66	2.5	3	882	872	882	152	87	92	24.7
Merit x Pilot	1860	12355	33.8	57.0	14.9	13.9	71.2	.59	68	2.0	3	845	867	881	152	90	92	21.9
Pilot x Mida	1953	12445	39.1	61.4	14.7	13.4	72.9	.43	64	2.0	0	850	862	877	147	95	93	27.4
Comet		11495	35.4	58.3	13.5	12.3	75.6	.45	65	2.0	0	752	745	769	152	83	85	29.2
Pilot x Merit	1984	12443	36.4	58.1	14.8	13.5	72.7	.47	63	1.5	2	839	851	865	150	83	90	26.2
Merit x Thatcher	2104	12540	36.8	57.1	15.2	14.2	71.2	.59	70	3.0	1	865	850	865	154	90	90	22.0
Merit x Pilot	1764	12315	37.3	57.0	15.1	14.1	70.3	.59	68	2.5	1	859	845	859	154	83	88	22.1
2744 x 2809	3175	12440	36.5	58.4	15.7	14.3	72.5	.50	66	2.0	2	847	846	856	148	83	93	28.2
Pilot x Mida	1756	12303	38.5	58.0	14.5	13.4	72.5	.45	64	2.0	0	847	832	856	150	88	93	32.1
1750 x 1753	2092	12549	39.6	59.1	15.3	14.1	71.6	.52	66	2.0	0	839	818	843	150	82	88	26.9
Pilot x 1753	2014	12476	35.1	58.5	14.6	13.2	72.0	.51	64	1.5	2	812	829	839	150	78	90	26.7
Pilot x 1514	2105	12541	36.4	59.2	14.6	13.3	71.8	.46	63	1.5	3	835	813	835	148	92	92	28.3
1691 x 1756	1792	12362	32.2	56.6	14.8	13.8	72.2	.59	70	2.5	0	821	825	827	153	83	88	22.0
Merit x Pilot	1831	12363	38.2	58.4	14.8	13.9	73.9	.42	64	1.5	0	801	803	818	148	85	90	30.6
Mida x Cadet	1750 x 1753	12550	34.1	59.0	14.8	13.8	70.6	.55	66	2.0	1	812	788	812	152	87	83	24.1
Pilot		11945	39.9	59.3	12.3	11.2	72.9	.49	64	2.0	0	707	709	761	150	83	82	24.3
Average			35.9	58.1	14.9	13.9	72.4	.51	66	2.1	1.1	856	846	869	150	86	90	26.8
Range			11.0	6.0	3.8	4.1	5.4	.16	7	1.5	3.0	235	222	213	8	17	10	10.2

UNIFORM REGIONAL NURSERY

Twenty-six wheats from the Uniform Regional Nursery have been tested for their milling, baking and chemical properties. The Eastern composite was composed of grain from eight stations and the grain from five dry-land stations made up the Western composite. The grain from three irrigated stations was not included nor tested. The results of the quality tests for the Eastern and Western composites and the average of both composites are shown in table 4. Seven of the strains have been included in the nursery for 2 years and three of them for 3 years. This discussion which follows is based principally on the average of the Eastern and Western composites. Acre yields ranged from 19.5 bu. for Rescue to 29.1 bu. for Hope x Tinstein II-39-51.

The test weight of the samples was not high with three of the strains averaging lower than 58 pounds. These were Redman, 2809 x 2822 Ns. 3129 and Rescue. Thatcher x Triunfo S. D. 343 averaged highest in test weight among the 1947 Regional Nursery samples. The flour yields varied over a wide range. A number of the strains yielded a high percentage of flour, some exceeding others with higher test weights. Mida x Cadet N. 1831 and 2809 x 2822 Ns. 3129, were highest in flour yield. These also were among the highest of the 1946 samples. Others of the 1947 samples that were high were Regent x Mida (1843. 41), Hope x Tinstein II-39-51, 2809-2822-Premier, Ns. 3150 and 2744 x 2809, Ns. 3190.

There was some variation in the milling characteristics. A number were much harder than Thatcher and required extra reductions in the mill for the production of flour. These included H.R.R. x Mercury, S. D. 1691, 1449 x Pilot N. 2088, Premier x Tinstein II-39-57 and the Hope x Tinstein strains II-39-46, II-39-47 and II-39-51. Premier x Tinstein had the hardest grain of the strains compared. It milled with difficulty (very hard kernel) needing more reduction than any of the other wheats studied. These differences, however, as compared with Thatcher and Marquis were not expressed by the pearling indices. One of the newer strains 1449 x Pilot N. 2088 was found to generally mill satisfactory but was slightly harder than the typical hard red spring varieties. Thatcher x Triunfo S.D. 343 was one of the softest textured strains among the Uniform Regional Nursery samples. This strain milled very soft, was difficult to sieve or bolt and produced a "fibrous and cottony like" flour. Thatcher x Triunfo also had a high pearling index value. The pearling index values were lowest for Merit² x Thatcher N. 2104 and Pilot x Merit N. 1898, both being materially less than for Thatcher.

A number of the wheats averaged high in wheat protein. Those averaging 15.0 percent or higher were 2744 x 2809 Ns. 3264, Pilot x Merit N. 1898, Tinstein x Mida II-42-1, 2809 x 2822 Ns. 3129, 2744 x 2809 Ns. 3175, Thatcher x Triunfo S.D. 343, 2809-2822 Premier Ns. 3150, H.R.R. x Mercury S.D. 1691, Premier x Tinstein II-39-57 and Hope x Tinstein II-39-46, II-39-47 and II-39-51. Tinstein x Mida was highest of the group, and averaged 16.1 percent in protein due in part to its low yield. The Hope x Tinstein strains as a group have averaged uniformly high in protein for the last 2 years. Three of the wheats, lowest in wheat protein from the 1947 regional nursery averaged 13.8 to 14.1 percent. These were Mida x Cadet N. 1831, Pilot x Merit N. 1969, and Marquis.

The flour ash content was generally high with only three strains averaging in the desired lower range. Those lowest were 1691 x 1756 N. 2105, Thatcher x W38- Hope W242, and 1449 x Pilot N. 2088.

There was a wide range in baking quality. Most of the volumes were good considering the protein content of the varieties and strains, more than half of them having optimum loaf volumes higher than 900 cc. Five of the strains having the highest loaf volumes were Hope x Timstein II-39-46 and II-49-37, 1552 x Mida, N. 2083, 2744 x 2809 Ns. 3264, and Pilot x Merit N. 1898.

Premier x Timstein II-39-57 ranked second highest in protein but had the lowest loaf volume and also averaged lowest in crumb color and grain-texture of the bread among the 26 wheats compared. Some of those that appeared to have good loaf volumes for a relatively low flour protein (13.1 to 13.5 percent) were 1691 x 1756 N. 2105, 2744 x 2809 Ns. 3190, Pilot x Merit N. 1969, Thatcher x W38-Hope W242 and Pilot x 1514 N. 2014. Hope x Timstein II-39-46 and Timstein x Mida II-42-1 averaged highest and 2744 x 2809 Ns. 3264 next best among the 26 wheats in crumb color and grain-texture of the bread. Others that were high in grain-texture of the bread were Redman, Mida x Cadet N. 1831, and Timstein x Mida II-42-1. The four strains having the lowest crumb color scores were 1552 x Mida N. 2083, 1449 x Pilot N. 2083, Rescue, and Thatcher x W38-Hope W242.

The water absorption of the flour varied over a range of 6.0 percent. Rescue was lowest and Pilot x Merit N. 1898, Hope x Timstein II-39-51 and II-39-47, and Merit² x Thatcher N. 2104 were highest.

Merit² x Thatcher had the longest mixing time and Thatcher x Triumpho the shortest. All within the range considered satisfactory for hard red spring wheat.

The response to oxidizing agents did not vary greatly among the 26 varieties and strains compared. All but three of the strains required larger amounts of oxidizing agents than Thatcher. This varied among the varieties and strains from twice to three times more bromate than required for Thatcher.

The following is a discussion of the principal quality characteristics of a number of the strains grown for 3 years (1945 to 1947, inclusive) and 2 years (1946 and 1947).

Mida x Cadet 1831 has produced the highest average yield in the Uniform Regional Nursery for the 3-year period 1945-1946 and 1947. It ranked highest in loaf volume by the optimum bake in 1945, but sixth in 1946 and ninth in 1947. The milling properties were satisfactory and the flour yield very good. It averaged for the 3 years 2.7 percent higher in yield of flour than comparably grown samples of Thatcher. The ash content of the flour was medium and the water absorption high. It averaged a half percent lower in protein, but was about the same in loaf volume, crumb color and grain-texture of bread as Thatcher.

The 2744 x 2809 Ns. 3175 which was the second highest yielding wheat for 3 years was also one of the best with respect to protein content of wheat. It was similar to Thatcher in milling quality. It averaged higher in test weight per bushel, yield of flour, crumb color and grain texture of bread than Thatcher, but was about the same as Thatcher in flour ash, and water absorption of flour.

2809-2822 x Premier, 3150 ranked third in yield per acre for 3 years, and has been one of the highest in yield of flour among the 26 wheats compared. It averaged slightly higher in protein content of wheat, about the same in water absorption of flour and loaf volume of bread by the optimum bake but better in crumb color and grain texture than Thatcher. The pearling index values of the grain suggest that it was one of the softest textured strains compared for the 3 years' tests.

Thatcher x W38 - Hope, Wis. 242 was the highest yielding wheat in the 1946 and 1947 Uniform Regional Nurseries. Its milling properties were satisfactory, yielding about the same percentage of flour as Thatcher. The pearling index values of the grain suggest that it is similar to Thatcher in texture or hardness of grain. It averaged about the same as Thatcher in loaf volume (optimum bake) water absorption of flour, crumb color and grain texture. It was one of the lowest in protein content and averaged slightly lower than comparably grown samples of Thatcher in flour ash. Baking tests show that it responds sharply to increasing amounts of bromate indicating that it may have a somewhat greater tolerance to fermentation than many of the other varieties.

Hope x Timstein II-36-46, continued for a second year in the Uniform Regional Nurseries, averaged third highest in acre yield for the 2 seasons. It was the best of the Hope x Timstein material tested in 1946 and has again in 1947 proved to be good in quality. It averaged about the same as Thatcher in yield of flour. The pearling index values of the grain suggest that it is softer in texture than many of the typical hard red spring wheats and may possibly mill with difficulty under certain commercial milling practices. It exceeded Thatcher in test weight per bushel, but was about the same as Thatcher in flour ash, loaf volume of bread by the optimum bake, and grain texture. It has been one of the more promising strains in crumb color of bread averaging much better (whiter) in this respect of the 26 wheats compared. It has been one of the highest in protein content among the 26 varieties studied from the Regional Nurseries during the last 2 years.

Pilot x Merit, 1898, ranked fourth in yield per acre for 2 years and has averaged about the same as Thatcher in test weight, protein content of wheat, loaf volume by the optimum bake, and grain texture of the bread. It has averaged slightly lower in yield of flour but has a higher flour ash and water absorption of flour than Thatcher. The pearling index values were low in both years, suggesting that it is harder in texture than comparably grown samples of Thatcher. Pilot x Merit requires a medium amount of bromate for optimum bread and averages medium to long in dough mixing time.

Pilot x 1514, 2014, grown for the past two seasons, has averaged higher than Thatcher in acre yield, and test weight per bushel. It is approximately equal to Thatcher in loaf volume by the optimum bake, grain texture and crumb color, has a lower flour ash, flour yield and protein content in the wheat. The flour is granular and similar in this respect to Thatcher.

2744 x 2809, 3190, tested for 2 years averaged higher than Thatcher in acre yield, test weight per bushel, yield of flour, and grain texture of bread. It has averaged slightly lower in loaf volume of bread by the optimum bake but has a higher water absorption of flour than Thatcher. It requires little or no bromate for optimum bread and is among one of the lowest in this respect of the strains tested. It averages medium to long in mixing time.

Table 4.--Yield, milling, baking, and chemical results on 26 wheats grown in the Uniform Regional Nursery for Eastern Composite, Western Composite, and averages of Eastern and Western Composites in 1947.

Eastern Composite 1/

Average or Cross	State or N.No.	C.I. No.	Acre Yield	Bu. Yield	Test Wt.	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Opti- mum Bro- mate	Method and volume			Average		Pearling Index	
						Wheat	Flour	Yield	Ash				No.6	Aver. 3 best	Opti- l'm	Weight of loaf	Crumb color	Grain- tex- ture	Value Pct.
						Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Wt.	Cc.	Cc.	Cc.	Grams	Score	Score	
Redman	1834.1	12496	26.9	59.1	14.1	13.5	72.5	.51	65	2.5	1	934	885	934	154	90	92	28.8	
N.S. 2809xNS	2822 3129	12437	27.7	58.0	15.0	13.9	75.0	.49	65	2.0	1	924	873	924	151	80	85	32.6	
Wida x Cadet	1831	12363	30.2	60.3	13.8	13.2	76.3	.48	66	2.0	2	911	889	919	153	87	93	27.2	
NS. 2744xNS	2809 3264	12548	30.4	61.1	14.7	13.6	73.7	.49	66	2.0	1	919	866	919	152	92	93	30.4	
Pilot x 1514	2014	12476	28.8	61.7	14.0	13.1	72.4	.45	67	2.5	0	898	891	916	154	82	90	26.1	
Hope x Timstein	11-39-46	12488	32.9	60.9	15.3	14.4	73.1	.41	66	2.5	1	916	880	916	150	92	93	29.3	
1552 x Wida	2083	12543	32.2	61.8	13.5	12.6	74.0	.50	64	2.0	1	914	870	914	154	75	90	27.6	
Regent x Wida	1843.41	12542	26.5	61.4	14.1	13.5	73.7	.47	64	2.5	1	911	888	911	151	82	88	28.5	
1449 x Pilot	2088	12491	26.0	61.4	13.7	12.9	73.4	.45	64	2.5	1	911	899	911	148	78	92	29.3	
Hope x Timstein	11-39-47	12545	30.9	61.0	14.9	14.2	72.1	.46	70	3.0	1	886	880	899	154	92	92	27.8	
1 Hope x Timstein	11-39-51	12546	32.3	60.2	14.8	14.1	73.9	.48	70	2.0	2	886	856	894	154	88	90	28.9	
Pilot x Merit	1898	12442	30.3	60.1	14.2	13.2	72.8	.52	69	2.5	2	876	861	886	156	80	88	22.0	
NS. 2744xNS	2809 3175	12440	29.5	61.0	14.4	13.4	74.3	.52	66	2.5	1	885	849	885	151	87	92	29.1	
Merit x Thatcher	2104	12540	28.3	60.3	14.1	13.1	70.5	.50	69	3.0	2	865	841	881	153	88	88	21.1	
Thatcher x Triumph	343	12497	30.9	62.5	14.9	13.5	70.3	.46	63	1.5	1	878	823	878	151	92	83	37.1	
1691 x 1756	2105	12541	28.3	61.1	13.8	12.7	72.6	.38	66	2.0	0	842	841	876	154	93	90	29.6	
Timstein x Wida	11-42-1	12544	25.7	61.6	15.7	14.5	70.4	.52	67	2.0	1	874	842	874	151	93	93	27.7	
Rescue	4186	12435	19.7	57.8	14.1	13.5	69.8	.46	63	2.0	2	862	834	873	148	73	87	27.7	
Thatcher x W-38	Hope	12484	31.9	60.2	13.4	12.4	73.4	.38	64	2.5	1	866	826	866	150	78	88	28.3	
Thatcher	Hope	10003	23.8	59.6	14.0	13.2	71.7	.53	66	2.5	1	865	851	865	151	83	90	25.6	
H.R.R. x Mercury	1691	12499	26.9	60.8	14.7	13.7	70.5	.49	65	2.0	1	853	833	853	149	83	90	31.2	
Pilot x Merit	1969	12490	28.8	60.1	13.3	12.3	74.0	.50	64	2.0	1	853	827	853	148	82	90	33.8	
NS. 2744x NS	2809 3150	12489	31.3	60.6	14.1	13.1	74.6	.50	66	2.5	2	842	824	853	151	78	90	27.7	
N.S. 2809-2822 x	Premier	3150	30.8	61.5	14.4	13.5	73.7	.51	66	2.0	1	851	832	851	152	88	88	31.6	
Marquis	3641	22.0	59.1	13.2	12.6	70.9	.54	65	2.5	0	803	805	833	150	83	88	25.8		
Premier x Timstein	11-39-57	12547	29.3	60.4	15.5	14.5	71.5	.53	65	1.5	1	752	729	752	152	78	80	27.5	
Average			28.5	60.5	14.3	13.4	72.7	.48	66	2.3	1.1	877	849	882	152	85	89	28.6	
Range			13.2	4.7	2.5	2.2	6.5	.16	7	1.5	2.0	182	162	182	8	20	13	16.0	

1/ Average eight Eastern stations--Madison, St. Paul, Waseca, Morris, Crookston, Langdon, Fargo and Brookings.

Table 4.--Continued

Western Composite 1/

Variety or Cross	State or N.No.	C.I. No.	Acres Yield	Test Wt.	Protein		Flour		Ab- sorp- tion	Mix- ing Time		Opti- mum Bro- mate	Method and volume		Weight of loaf	Average Crumb		Grain- tex- ture	Pearling Index
					Wheat	Pct.	Yield	Pct.		Min.	Pct.		No. 6	Aver. 3		color	Score		
			Bu.	Ibs.	Pct.	Pct.	Pct.	Pct.		Min.	Pct.	mi.	Cc.	Cc.	Grams	Score	Score		Pct.
Hope x Timstein	II-39-46	12488	26.2	58.4	15.8	14.9	71.8	.57	69	2.5	1	975	953	975	153	95	92	29.5	
Pilot x Merit	1898	12442	24.6	57.4	15.8	14.5	68.9	.57	68	2.5	0	942	948	971	152	92	92	21.8	
1552 x Mida	2083	12543	25.9	59.3	15.3	14.3	69.4	.55	67	2.0	1	968	924	968	153	80	88	27.0	
Regent x Mida	1843.41	12542	22.9	59.5	15.6	14.8	73.1	.54	68	2.5	1	965	949	965	151	82	87	28.6	
Timstein x Mida	II-42-1	12544	22.0	60.2	16.5	15.5	70.7	.51	67	2.0	2	911	923	963	151	95	92	27.6	
Hope x Timstein	II-39-47	12545	27.7	57.3	15.6	14.5	70.8	.48	67	2.0	2	945	915	959	153	87	88	32.2	
2744 x 2809	3264	12548	22.3	59.3	15.3	14.0	71.4	.48	67	2.0	1	951	924	951	152	93	87	29.8	
T hatcher		10003	23.3	56.8	15.2	14.6	71.8	.49	65	2.5	0	948	918	948	152	80	92	25.9	
1449 x Pilot	2088	12491	22.5	58.2	15.0	14.2	72.0	.47	63	2.0	1	937	910	937	148	80	90	29.2	
Thatcher x W-38-Hope W. 242		12484	23.5	56.8	15.2	14.2	70.8	.52	66	2.5	0	911	912	934	151	82	90	27.6	
Rescue		12435	20.2	56.8	15.1	14.4	69.6	.47	63	2.0	1	930	897	930	151	75	88	27.4	
Merit x Thatcher	2104	12540	24.1	58.1	15.4	14.5	69.8	.61	69	2.5	0	908	901	922	154	92	92	20.1	
Mida x Cadet	1831	12363	26.5	58.4	14.4	13.9	74.4	.51	65	2.0	1	916	904	916	152	80	92	26.4	
Pilot x Merit	1969	12490	21.9	58.0	14.7	13.6	70.9	.49	65	2.0	0	892	895	916	151	83	92	24.1	
Pilot x 1514	2014	12476	23.7	58.7	14.8	13.7	69.1	.53	64	2.0	1	913	887	913	152	82	88	26.4	
Redman		12496	20.4	56.6	15.1	14.5	71.9	.50	64	2.0	0	892	887	911	150	88	93	28.1	
2809 x 2822	3129	12437	23.7	57.0	15.5	14.3	74.5	.46	64	1.5	2	873	867	885	153	87	88	31.0	
2809-2822 x Premier	3150	12438	22.2	59.7	15.6	14.9	74.2	.54	66	2.0	1	885	864	885	154	83	90	31.4	
2744 x 2809	3175	12440	23.7	59.1	15.5	14.3	72.3	.56	68	2.0	1	879	865	879	152	87	92	27.5	
2744 x 2809	3190	12489	24.5	58.6	15.0	13.9	72.4	.53	69	2.5	0	865	865	870	153	85	90	27.5	
H.R.R. x Mercury	SD1691	12499	21.4	59.0	15.4	14.0	69.1	.44	65	2.0	0	818	826	868	150	80	88	29.1	
Thatcher x Triumph	SD343	12497	19.1	60.1	15.8	14.6	70.7	.55	62	1.5	1	863	835	863	153	88	85	36.9	
Hope x Timstein	II-39-51	12546	27.0	60.0	15.3	14.3	72.8	.58	67	2.0	1	853	837	853	156	93	90	27.5	
Marquis		3641	18.7	57.0	14.3	13.6	69.9	.48	65	2.5	2	830	815	843	150	80	85	25.2	
1691 x 1756	2105	12541	25.3	59.0	14.9	13.8	71.4	.50	64	1.5	2	836	822	841	153	85	85	20.2	
Premier x Timstein	II-39-57	12547	22.6	58.8	16.1	14.7	69.2	.59	63	1.0	2	553	573	588	155	57	57	27.0	
Average			23.5	58.4	15.3	14.3	71.3	.52	66	2.1	0.9	891	878	902	152	85	88	27.8	
Range			9.0	3.4	2.1	1.9	5.6	.17	.7	1.5	2.0	422	380	387	8	38	36	16.8	

1/ Composite, five western dry land stations--Mandan, Dickinson, Havre, Alliance and Akron.

Table 4.--Continued

Average of Eastern and Western Composite

Variety or Cross	State or N.No.	C.I. No.	Acres Yield	Test Wt. Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Opti- mum Bro- mate	Method and No. 6 best		Average Crumb		Grain- tex- ture	Pearling Index
					Pct.	Pct.	Pct.	Pct.						Weight of loaf	Score		
Hope x Timstein	IL-39-46	12488	28.9	59.7	15.6	14.7	72.5	49.68	2.5	1.0	946	917	946	152	94	93	29.4
1552 x Mida	2083	12543	28.3	60.6	14.9	13.5	71.7	53.66	2.0	1.0	941	897	941	154	78	89	27.6
Regent x Mida	1843.41	12542	24.2	60.5	14.4	14.2	73.4	53.66	2.5	1.0	838	919	838	151	82	88	28.6
2744 x 2809	3264	12548	26.0	60.2	15.0	13.8	72.6	49.67	2.0	1.0	935	905	935	152	93	90	30.1
Pilot x Merit	1898	12442	27.0	58.8	15.0	13.9	70.9	55.69	2.5	1.0	909	905	929	154	86	90	21.9
Hope x Timstein	IL-39-47	12545	28.3	59.2	15.3	14.4	71.5	47.69	2.5	1.5	922	898	929	154	90	90	30.0
1449 x Pilot	2088	12491	23.8	59.8	14.4	13.6	72.7	46.64	2.3	1.0	924	892	924	148	79	91	29.3
Redman		12496	23.4	57.9	14.6	14.0	72.2	51.65	2.3	1.5	913	886	923	152	89	93	28.5
Mida x Cadet	1831	12363	27.6	59.4	14.1	13.6	75.4	50.66	2.0	1.5	914	897	918	153	84	93	26.8
1 Timstein x Mida	IL-42-1	12544	23.4	60.9	16.1	15.0	70.5	52.67	2.0	1.5	893	883	918	151	94	93	27.7
2 Pilot x 1514	2014	12476	25.8	60.2	14.4	13.4	70.8	49.66	2.3	0.5	906	889	915	153	83	89	26.3
2 Thatcher	Check	10003	23.0	58.2	14.6	13.9	71.8	51.66	2.5	0.5	907	885	907	152	82	91	25.8
1 2809 x 2822	3129	12437	25.0	57.5	15.3	14.1	74.8	48.65	1.8	1.5	899	870	905	152	84	87	31.8
Merit x Thatcher	2104	12540	25.5	59.2	14.7	13.8	70.2	56.69	2.8	1.0	887	871	902	154	90	90	20.6
Rescue		12435	19.5	57.3	14.6	14.0	69.7	47.67	2.0	1.5	896	866	902	150	74	88	27.6
Thatcher x W38-Hope	W.242	12484	27.2	58.5	14.3	13.3	71.6	45.65	2.5	0.5	889	869	900	151	75	89	28.0
Pilot x Merit	1969	12490	25.1	59.1	14.0	13.0	72.5	50.67	2.0	0.5	873	861	885	150	83	91	29.0
2744 x 2809	3175	12440	26.0	60.1	15.0	13.9	71.3	54.65	2.3	1.0	882	857	882	152	87	92	28.3
Hope x Timstein	IL-39-51	12546	29.1	60.1	15.1	14.2	73.4	53.69	2.0	1.5	870	847	874	155	91	90	28.3
Thatcher x Triunfo	SD343	12497	24.8	61.3	15.4	14.1	70.5	51.67	1.5	1.0	871	829	871	152	90	84	37.0
2809-2822-Premier	3150	12438	26.0	60.6	15.0	14.2	74.0	53.66	2.0	1.0	868	848	868	153	86	89	31.5
2744 x 2809	3190	12489	27.1	59.6	14.6	13.5	73.5	52.68	2.5	1.0	854	845	862	152	82	90	27.6
H.R.F. x Mercury	SD1691	12499	23.6	59.9	15.1	13.9	69.8	47.65	2.0	0.5	836	830	861	150	82	89	30.2
1691 x 1756	2105	12541	26.0	60.1	14.4	13.3	72.0	44.65	1.8	1.0	839	832	859	154	89	88	28.9
Marquis	Check	3641	19.9	58.1	13.8	13.1	70.4	51.65	2.5	1.0	817	810	838	150	82	87	25.4
Premier x Timstein	IL-39-57	12547	25.3	59.6	15.8	14.6	70.4	56.64	1.8	1.5	653	651	670	154	68	69	27.3

Average
Range26.0 59.5 14.8 13.8 72.0 50 66 2.2 1.0 884 864 892 152 85 89 28.2
9.6 4.0 2.3 2.0 5.7 .11 6 1.0 .5 293 269 276 7 26 24 16.4

Table 5.--Yield, milling, baking and chemical results on hard red spring wheats grown in North Dakota Intrastate Nursery composited from stations indicated, 1947 crop.

N. Dakota Interstate Nursery 1/

Variety or Cross	State or N.No.	C.I. No.	Acre Yield Bu.	Test Wt. Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing Time Min.	Opti- mum Bro- mate	Method and volume		Average		Pearling Index
					Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.				No.6 Cc.	Aver. 3 best Cc.	Weight of leaf Grams	Crumb color Score	
Regent x Pilot	1920		30.1	62.1	15.4	14.3	72.5	.51	65	2.0	0	956	922	150	85	26.6
9.21.2.28	3292		33.4	61.2	16.3	15.2	71.8	.54	68	3.0	1	959	907	155	90	24.0
9.21.2.49	3310		30.9	61.1	15.1	14.2	72.3	.45	64	2.5	1	953	894	150	83	27.2
Merit x Thatcher	12494		30.7	59.8	15.1	14.3	73.6	.63	70	3.0	1	948	891	156	87	21.3
9.21.2.24	3295		31.7	60.7	16.0	14.8	72.2	.55	68	3.0	1	945	883	156	83	25.7
1556 x Mida	2222		28.7	61.3	15.4	14.3	73.1	.48	66	2.0	1	939	902	155	90	27.8
Thatcher	Check		31.1	60.6	14.9	14.3	72.9	.45	66	2.5	0	929	903	151	73	25.4
1556 x Mida	2223		29.9	61.8	15.3	14.2	72.8	.46	64	2.0	1	937	902	152	83	28.8
9.21.2.18	3270		31.7	60.9	16.1	14.9	72.6	.45	65	2.0	1	925	880	151	85	28.8
9.21.2.3	3275		32.3	60.8	16.1	14.9	71.5	.47	65	2.5	0	919	896	152	87	27.3
Spinkoota	12499		34.9	61.7	16.8	15.7	69.1	.52	60	2.0	1	917	850	152	77	34.0
Pilot x Mida	1953		31.5	62.8	14.9	13.8	71.9	.45	64	2.0	1	911	863	151	83	26.9
Merit x Pilot	2012		31.3	60.4	15.2	14.2	72.5	.51	65	2.5	1	909	884	151	92	22.0
1552 x Mida	12482		29.8	61.7	14.8	13.6	74.9	.48	65	2.0	1	906	877	152	83	28.3
1568 x Merit	2114		26.9	61.7	15.3	14.2	74.4	.48	67	2.5	1	903	857	152	85	23.4
Pilot x Mida	1785		31.6	60.8	15.1	14.2	72.9	.50	64	2.0	1	901	865	154	88	25.9
1568 x Merit	2120		31.9	61.1	15.0	14.0	73.8	.41	65	2.5	1	900	858	149	85	25.6
1750 x 1753	2115	12640	30.7	62.2	15.6	14.4	74.3	.48	66	2.5	1	894	841	151	85	25.2
04.2.1	3167		32.4	60.7	15.8	14.8	74.3	.48	62	2.0	1	876	839	153	85	23.8
9.21.3	3166		34.1	60.7	15.4	14.3	73.4	.49	65	2.5	1	871	854	151	87	26.7
Mercury x Komar	2010	12483	36.1	62.2	15.2	13.9	73.3	.45	66	2.0	1	871	825	156	85	23.2
Hussar																
1691 x 1756	2035	12492	33.9	62.1	14.7	13.4	73.0	.46	66	2.0	1	870	815	155	85	26.1
1.3.32	3210		38.2	61.2	15.0	14.0	77.2	.53	67	3.0	0	821	816	153	83	23.7
C.-K.H. x Mercury	1882		32.9	60.0	14.5	13.7	76.4	.53	67	2.0	0	839	813	154	77	22.6
1568 x Merit	2130		30.7	62.3	14.4	13.4	72.9	.43	68	3.0	0	775	768	155	72	23.1
9.21.1	3174		34.4	61.5	15.4	14.2	72.7	.54	64	2.0	1	824	791	153	87	24.2
Average			32.0	61.3	15.3	14.3	73.2	.49	65	2.3	0.8	900	861	153	84	25.7
Range			11.3	3.0	2.4	2.3	8.1	.22	8	1.0	1.0	184	154	7	20	12.7

1/ Fargo, Langdon, Mandan and Dickinson

Table 6.---Continued

Landon, N. Dakota

Variety or Cross	State or N.No.	C.I. No.	Acre Yield	Test Wt.	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Method and volume			Average		Pearling Index
					Wheat	Pct.	Yield	Ash			No. 6	Aver. 3.	Weight of loaf	Crumb color	Grain- tex- ture	
Pilot ² x Merit	2174		23.3	58.1	16.0	15.2	71.2	.51	.66	3.0	1	1101	1014	92	87	21.4
Pilot ² x Comet	1915		24.2	60.5	15.4	14.8	72.5	.43	.65	2.5	1	1055	969	90	85	28.1
1750 x 1753	2092	12549	24.7	60.6	15.0	14.4	73.9	.45	.65	3.5	1	1030	962	85	85	26.9
1750 x 1753	2095	12551	27.3	61.5	15.8	14.9	73.3	.40	.66	2.5	1	1024	951	92	92	27.0
Pilot x 1514	1931		28.1	61.6	15.5	14.7	73.8	.43	.65	2.5	1	995	937	85	90	27.6
1568 x Merit	2011		28.1	59.2	15.2	14.7	74.8	.47	.65	3.0	1	992	922	78	85	23.8
1764 x 1750	2173		22.1	59.2	15.1	14.4	73.9	.46	.64	2.5	1	968	896	93	90	26.4
1568 x Merit	2168		25.4	61.5	15.0	14.3	74.6	.45	.66	2.5	1	965	907	88	83	22.9
1750 x 1753	2093	12550	24.7	61.2	15.0	13.9	73.2	.45	.65	2.5	1	965	907	93	85	25.6
Thatcher		10003	17.9	57.1	15.0	14.3	74.1	.46	.66	3.0	2	948	924	83	88	24.0
1764 x 1750	2169		24.0	60.2	15.4	14.7	73.6	.55	.69	3.0	1	959	935	90	88	23.6
Pilot x 1585	2171		17.2	57.7	14.8	13.8	71.7	.42	.63	2.5	1	959	924	80	88	25.0
1520 x 1753	2102		24.3	62.3	14.8	14.2	72.2	.43	.66	3.5	0	919	905	95	87	26.7
Pilot ² x Regent	2175		19.3	60.1	15.2	14.3	72.9	.48	.64	2.5	1	925	886	93	87	26.1
1750 x 1753	2172		24.5	60.7	14.6	13.8	72.2	.44	.64	2.5	1	905	872	90	85	24.9
Average			23.7	60.1	15.2	14.4	73.2	.46	.65	2.8	1.0	981	927	88	87	25.3
Range			10.9	5.2	1.4	1.4	3.6	.15	.6	1.0	2.0	196	142	17	9	6.7

Mandan, N. Dakota

Pilot ² x Thatcher	2030		31.3	59.4	13.9	12.5	69.1	.47	.62	2.0	0	812	815	85	90	25.6
Pilot x 1315	2064		23.2	59.7	13.6	12.7	72.6	.48	.68	2.5	1	830	810	85	88	29.2
Pilot x 1315	2061		24.2	59.7	13.5	12.9	72.6	.52	.68	2.5	1	824	795	83	88	29.3
Thatcher		10003	21.1	60.0	13.6	12.8	73.3	.59	.68	2.5	0	764	767	78	87	26.1
Pilot ² x Merit	2137		23.5	60.5	12.7	11.6	71.5	.53	.69	2.5	0	767	771	87	87	22.9
Regent x Merit	2123		24.1	60.0	13.2	12.7	74.4	.51	.69	2.5	1	784	775	80	87	27.3
1585 x Cadet	2118		21.3	61.0	12.7	11.6	73.1	.54	.67	2.5	0	747	742	67	87	27.2
1615 x Pilot	1902		24.3	60.5	13.6	12.7	69.8	.69	.71	2.5	0	677	686	75	80	18.5
Merit ² x Thatcher	2112		24.0	58.0	12.9	11.8	70.3	.60	.70	3.0	0	747	734	77	87	20.4
1691 x 1756	2034		22.1	59.5	12.9	11.8	72.6	.46	.65	2.0	0	646	667	73	78	27.0
Wida x 1577	1985		23.9	61.3	12.5	11.6	73.9	.62	.67	2.5	0	723	717	72	83	25.4
Regent x 11392	2123		25.8	60.5	12.5	11.4	72.0	.52	.68	2.5	0	652	680	77	82	25.0
1615 x Pilot	1976		23.2	59.6	12.8	11.8	71.1	.66	.69	2.5	0	709	693	72	80	20.7
Pilot ² x Merit	2164		32.9	60.5	12.3	11.2	70.8	.54	.70	3.0	0	686	702	75	82	20.7
1615 x Pilot	2177		28.7	58.8	11.9	10.4	70.3	.49	.66	2.5	0	643	663	75	78	25.4
1691 x 1756	2176		23.2	61.1	12.4	11.3	74.2	.51	.65	2.5	0	612	644	77	78	28.4
Average			24.8	60.0	12.9	11.9	72.0	.55	.68	2.5	0.2	726	729	77	84	24.9
Range			11.8	3.3	2.0	2.4	4.1	.21	.9	1.0	1.0	218	171	20	12	10.8

Table 6.--Continued

Dickinson, N. Dakota

Variety or Cross	State or N.No.	C.I. No.	Acre Yield	Bu.	Test Wt. lbs.	Protein		Flour		Ash Pct.	Ab- sorp- tion	Mix- ing Time	Opti- mate Bro- mate	Method and volume		Weight of loaf	Average		Grain- tex- ture	Pearling Index	
						Wheat Pct.	Flour Pct.	Yield Pct.	No.6 Cc.					Aver. 3 best Cc.	Opti- mum Cc.		Grams	Crumb color			Score
1556 x 1563	2156		29.8	58.7		16.7	15.5	68.5	.45	64	1.5	1		980	951	980	150	88		92	32.6
1556 x Pilot	2141		30.6	58.6		16.5	15.8	70.1	.50	64	1.5	0		922	917	928	150	82		90	31.9
Pilot x Premier	2157		27.7	59.8		16.4	15.6	73.3	.51	65	2.0	1		928	894	928	150	97		93	30.3
1552 x Wida	2153		31.7	60.2		15.6	14.6	72.2	.48	66	2.0	1		902	887	902	152	85		88	30.0
1552 x Wida	2084		31.2	60.5		15.3	14.2	71.0	.47	63	1.5	0		883	849	883	153	82		90	29.4
Wida		12008	24.8	61.5		16.8	15.3	67.9	.45	66	1.5	0		789	787	815	150	88		90	31.1
Regent x Wida	1843.15		29.4	57.8		15.2	14.1	71.6	.48	64	1.5	1		812	798	812	150	80		90	29.0
Average			29.3	59.6		16.1	15.0	70.7	.48	65	1.6	0.7		888	869	893	151	86		90	30.6
Range			6.9	3.9		1.6	1.7	4.3	6	3	0.5	1.0		191	202	168	3	17		4	3.6

UNIFORM VARIETIES BAKED BY EIGHT METHODS

The same composite flours of seven uniform plot varieties (table 2) for the eastern and western sections were baked by eight methods. These included the regular bread-baking methods, including some with a shorter fermentation time, others with under mixing and over-mixing the doughs, the malt-phosphate-bromate method with a high percentage of yeast and the malt-bromate bake with high yeast but no phosphate. The malt-phosphate-bromate bake is used by Canadian and North Dakota laboratories. The results are given in table 7.

The shorter fermentation period (2-1/2 hrs.) produced somewhat smaller average loaf volumes than the longer (3.0 hrs.) fermentation period used in the regular no bromate method. The only exception to this is for Rival and Pilot from the eastern section, and Ceres in the western section, where the loaf volumes were largest for the shorter fermentation time. Over-mixing in general produced the largest loaves but the differences are not significant. The variety, Regent (eastern section), appeared to be injured by the long mixing period but the difference is not great. The varieties showing a high degree of tolerance to long mixing were Cadet, and Rival (eastern section) and Pilot and Ceres from the western section. Regent (eastern section) showed the largest decrease in loaf volume. The malt-phosphate-bromate and the malt-bromate bake, both methods with higher amounts of yeast than used in our regular method, produced loaves of somewhat lower loaf volumes than any of the other baking methods compared. Those varieties averaging best in loaf volume by the malt-phosphate-bromate and malt-bromate methods (average of the eastern and western results) were Cadet, Newthatch and Thatcher. The average of all methods show the varieties from the western section to be highest in loaf volume.

COMMERCIAL SAMPLES

As in past years a number of commercially grown wheat samples were obtained through the Grain Branch, Production and Marketing Administration for comparison with the varieties and strains produced in experimental plots. Seventeen such samples, representing a number of grades and types were obtained at Great Falls, Montana, and Minneapolis and Duluth, Minnesota. The samples were composited by grade from 3,303 cars of wheat grading No. 3 or better and represent the better grades of hard red spring wheats received at these markets. This is the ninth season such samples have been tested. The results are given in table 8.

As would be expected the samples from Great Falls, Montana, averaged higher in protein content and produced larger loaves of bread than those from Duluth or Minneapolis, Minnesota. Otherwise the milling, baking, and chemical results do not appear to be greatly different, especially when compared with samples having approximately the same protein content and test weight. The protein quality was good as based on the loaf volumes adjusted to a 13.0 percent protein basis in comparison with varieties from experimental plots and nurseries.

In general the differences between markets are in agreement with those between those from the plot and nursery lots from different areas.

Table 7.—Uniform Varieties, 1947, composited from Eastern and Western Sections and baked by 8 methods.

Section and Variety	Regular Methods mil. Bromate			0 with 2-1/2 hr. fer.	0 with 1 min. under mixing	0 with 1 min. over mixing	M.F.B. regu- lar bake	M.B. - P. bake	Average 8 methods
	0	1	2						
Eastern Section									
Calet	900	876	804	868	898	937	840	844	871
Regent	891	889	859	867	827	871	853	847	863
Newthatch	898	868	806	873	871	898	853	815	860
Mida	874	836	772	856	842	872	818	772	830
Thatcher	882	778	786	833	848	886	809	781	825
Rival	851	763	752	856	859	905	763	715	808
Pilot	818	755	767	883	809	836	809	735	802
Average	873	824	792	862	851	886	821	787	837
Western Section									
Newthatch	968	919	870	868	888	971	911	919	914
Cadet	943	898	896	922	905	934	898	898	912
Thatcher	962	911	842	923	910	948	900	901	912
Pilot	934	916	804	927	908	968	868	833	895
Mida	888	830	812	827	830	883	836	824	841
Ceres	850	833	780	876	818	873	856	777	833
Marquis	859	821	764	856	842	862	812	775	824
Average	915	875	824	886	872	920	869	847	876
Average of Eastern and Western Sections									
Cadet	922	887	850	895	902	936	869	871	892
Newthatch	933	894	834	871	880	935	882	867	887
Thatcher	922	845	814	878	879	917	855	841	869
Pilot	876	836	786	905	859	902	839	784	849
Mida	881	833	792	842	836	878	827	796	836
Average	907	859	815	878	871	914	854	832	867

Table 8.--Milling, baking and chemical results on seventeen composite commercial samples of hard red spring wheat obtained at Great Falls, Montana; Duluth, Minnesota; and Minneapolis, Minnesota representing the 1947 crop.

Location where obtained	Samples composited from car lots	U. S. Grade	Test Wt. Lbs.	Protein		Flour		Ab-sorption Pct.	Mix-ing Time Min.	Opti-mum Bro-mate		Method and volume		Average		Pearling	
				Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.			No.6	Aver. 3 best	Opti-mum Cc.	Weight of loaf Grams	Crumb color	Grain-tex-ture Score	Index value	Pct.
Great Falls, Mont.	278	1 Hvy. D.N.S.	61.1	14.0	13.2	73.9	.41	65	2.5	0	772	811	888	150	80	85	28.4
	475	1 D.N.S.	59.1	14.8	14.1	71.4	.45	64	2.5	0	845	850	903	151	90	87	28.9
	171	2 D.N.S.	57.7	15.6	14.9	72.4	.44	65	2.5	1	931	916	931	150	90	90	29.6
	92	2 D.N.S.	59.3	14.6	14.0	72.8	.44	64	2.5	0	879	862	898	151	83	88	29.3
	277	3 D.N.S.	56.2	16.2	15.4	71.5	.45	65	3.0	1	965	948	965	150	83	88	28.8
Do	46	4 D.N.S.	54.6	16.6	15.8	70.1	.46	65	3.0	1	1024	1002	1024	149	80	90	28.4
Duluth, Minnesota	111	1 Hvy. D.N.S.	60.8	13.0	12.4	75.4	.47	65	3.0	0	744	766	836	154	88	87	30.1
	319	1 D.N.S.	59.1	13.1	12.4	73.8	.46	64	3.0	0	760	785	845	151	85	85	28.6
	245	2 D.N.S.	57.8	13.4	12.7	72.9	.44	64	3.5	0	769	799	868	150	83	87	29.9
	303	3 D.N.S.	56.5	14.4	13.7	71.0	.45	63	3.5	0	815	840	905	150	80	87	30.2
	224	1 N.S.	59.0	13.2	12.4	75.6	.46	63	2.0	0	750	773	821	155	85	87	32.6
Do	102	2 N.S.	56.5	13.0	12.3	74.4	.46	63	2.0	0	778	776	824	153	85	87	31.7
Minneapolis, Minn.	130	1 Hvy. D.N.S.	61.1	12.5	11.9	75.7	.49	63	3.0	0	763	765	809	152	87	87	31.1
	150	1 D.N.S.	59.6	12.8	11.9	74.7	.51	64	3.0	0	729	753	812	152	83	83	29.8
	120	2 D.N.S.	56.9	13.3	12.5	73.2	.50	64	3.0	2	735	752	784	151	80	85	30.1
	115	3 D.N.S.	56.2	14.7	14.1	72.8	.49	65	3.0	0	862	881	928	149	83	88	29.6
	145	1 N.S.	59.5	12.4	11.6	75.2	.47	63	3.0	0	720	736	778	152	85	83	31.9
Average			58.5	14.0	13.3	73.3	.46	64	2.9	.3	814	824	872	151	84	87	29.9
Range			6.5	4.2	4.2	5.6	.10	2	1.0	2.0	304	266	246	6	10	7	4.2

CORRELATION AND REGRESSIONS

Correlation coefficients (r) for loaf volume and flour protein content of 12 varieties and strains and also the commercial grade samples have been calculated and are presented in table 9. Also indicated in this table is the slope of the regression line or the change in loaf volume for each 1.0 percent of protein (b_1), the average protein content of the flour and the loaf volumes of the bread, and the loaf volumes adjusted to a 13.0 percent protein basis by the means of the regression equation. The plotted regression lines for each variety and the commercial samples are shown in figures 1 and 2.

The figures show that the relation between loaf volume and protein content is generally linear. These results are in accordance with the last 3 years' (1944, 1945 and 1947) where, with a few exceptions the points fell on or very close to the calculated regression lines. Most of the correlation coefficients for loaf volume and flour protein content are high. The highest coefficients are for Henry, Hope & Tinstein, Commercial grades, Cadet and Ceres. The wheats having the lowest coefficients this season are Mida and Newthatch. These two varieties were among those that were lowest for last season. It should be noted that the number of samples of each variety is rather small for a study of this kind. This fact should be considered in evaluating the results.

One of the important results of this study and of interest are the differences in the level and particularly in the slope of the regression lines for the different varieties. The regression lines for the varieties and strains (4 varieties grouped together) have been included in separate graphs in figures 1 and 2 with the regression line for Thatcher repeated in each graph as a standard of comparison.

The regression line for Pilot (figure 1, A) is about the same in slope and level but slightly higher, while for Rival the regression line is slightly steeper and lower in the 10.0 to 13.0 percent protein ranges as contrasted to the line for Thatcher. The slope of the line for Mida is not as steep as the slope of lines for the other varieties compared in this group. The change in loaf volume for each 1 percent of protein for Mida is 42.9 cc., Pilot 54.4 cc., and Rival 58.7 cc. Rival has been one of the highest in this respect among the varieties compared during the last few seasons. The loaf volume of Pilot adjusted to a 13.0 percent protein basis according to the regression equation averaged 874 cc. and ranked second among the 13 comparisons made. The slope and level of the regression lines (figure 1, B) for Cadet, Newthatch and Regent are similar and average much like the regression line for Thatcher. The loaf volumes of Cadet and Regent adjusted to a 13.0 percent protein basis according to the regression equation agreed closely with the loaf volumes from last year's samples. The change in loaf volume for each 1 percent of protein was similar for all three varieties varying from 44.1 cc. for Regent; and 44.6 cc. for Newthatch to 45.3 cc. for Cadet.

The regression line (figure 2, A) for the commercial grades corresponds closely to that for Thatcher repeated in each graph as a standard of comparison. The slope of the line for Henry is somewhat greater than the slope of the lines for the other varieties and strains shown in those graphs. Most of the samples of Henry were from low protein areas. Henry averaged highest among the samples compared in change in loaf volume for

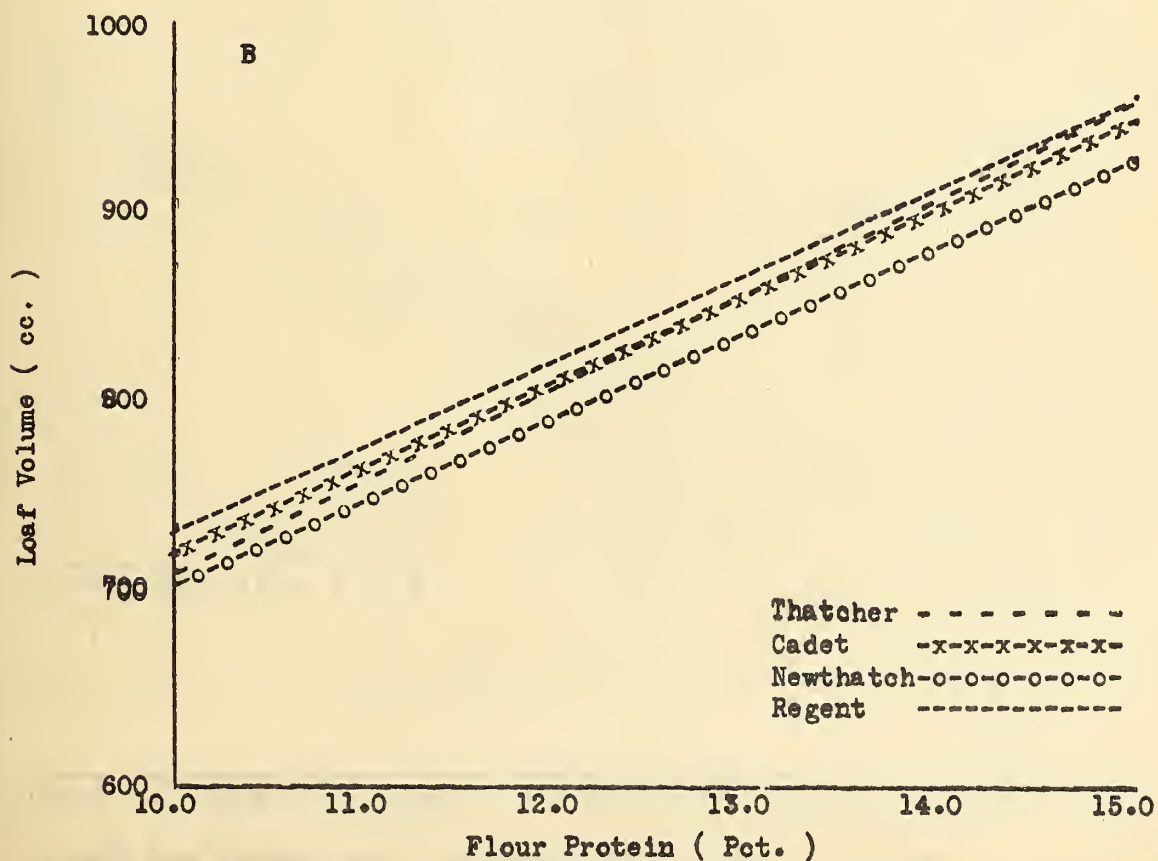
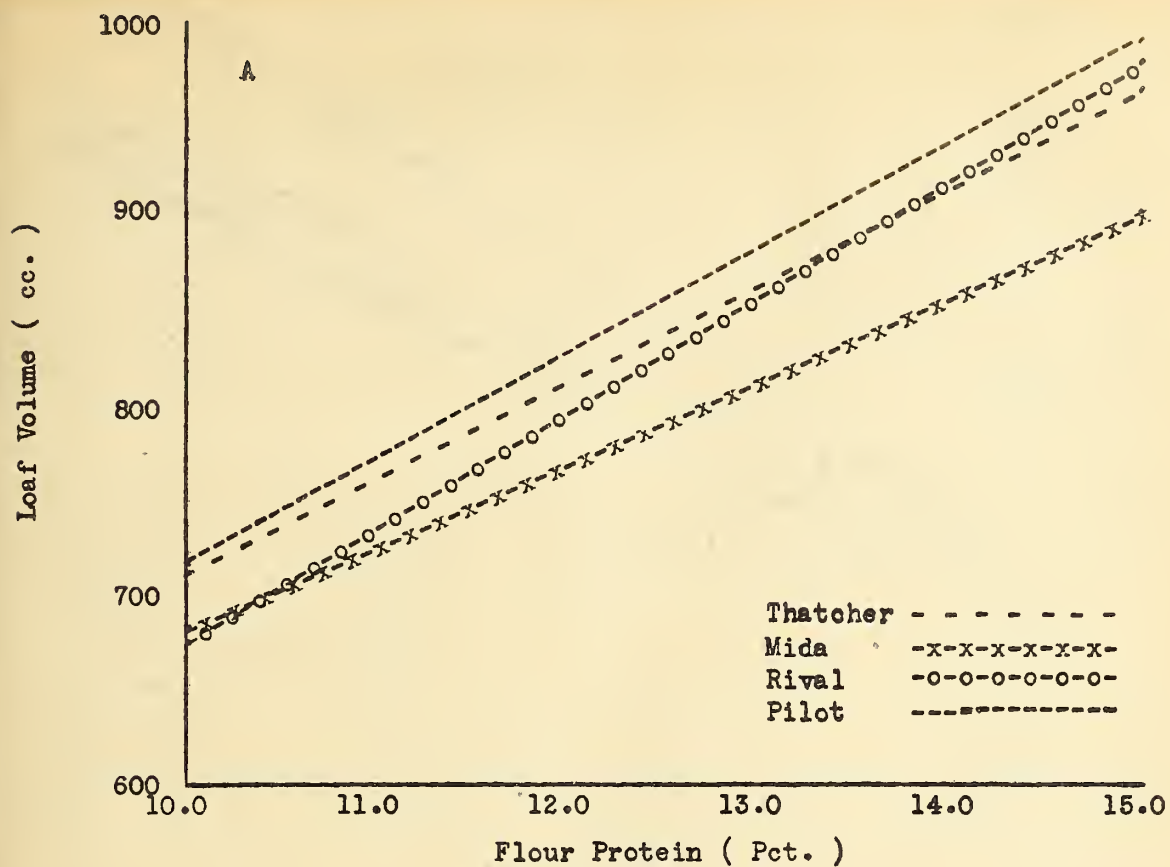


Figure 1. - Regression lines for flour protein and loaf volume for a number of hard red spring varieties and strains with Thatcher included for comparisons, 1947 crop.

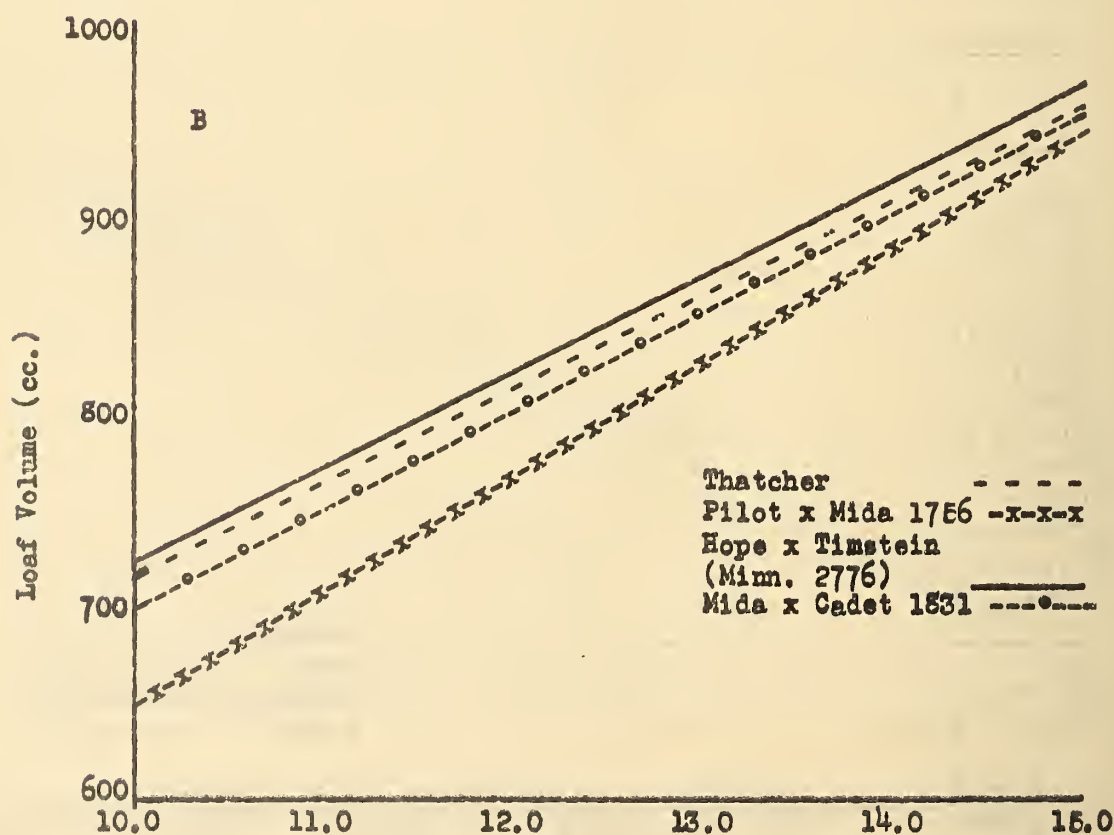
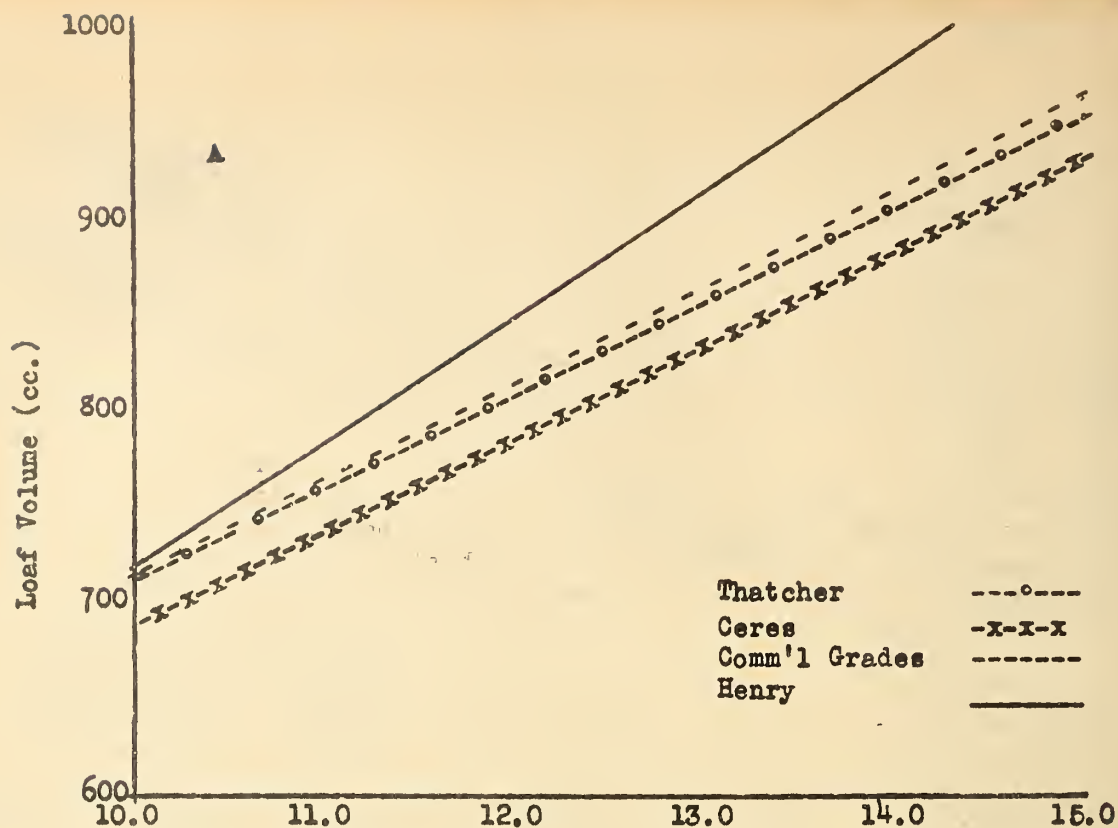


Figure 2. - Regression lines for flour protein and leaf volume for a number of hard red spring varieties and strains with Thatcher included for comparisons, 1947 crop.

each 1 percent of protein (66.7 cc.) and the loaf volume (914 cc.) adjusted to a 13.0 percent protein basis according to the regression equation. Henry has been one of the outstanding varieties in this respect during the last few years tested. The slope of the regression line for Ceres is lower but otherwise compares favorably with the slope of the line for Thatcher.

The regression lines for a number of the new and more promising strains are shown in figure 2, B. The slope of the lines for Hope x Tinstein (Minn. 2776) and Mida x Cadet 1831 compares favorably with the slope of the line for Thatcher while the slope of the line for Pilot x Mida 1756 is lowest of the group. Pilot x Mida has the largest change (58.7 cc.) in loaf volume for each 1 percent of protein among the samples compared in this figure. It was, however, lowest by comparison of the three strains in loaf volume (825 cc.) adjusted to a 13.0 percent protein basis according to the regression equation. Hope x Tinstein was the best of this group in loaf volume (868 cc.) converted to a 13.0 percent protein basis and ranked third among the 15 samples compared in the four graphs.

The relative position of the regression lines appears to be a rather satisfactory measure of the relative protein quality of these varieties. From these lines, the varieties and strains can be compared with each other by the means of loaf volume taken at a medium protein level (13.0 percent) as calculated from the regression lines. The loaf volume for each variety is the point at which the regression line crosses the 13.0 percent protein value in figures 1 and 2. These loaf volumes arranged in descending order are shown in the last column of table 9.

Table 9.--Summary of protein content - loaf volume.

Variety or Cross	: No. : : of : : Samples :	: b_1 ^{1/} : : r^2 ^{2/} :	: Prot.: Aver.: Loaf volume : of : loaf : at 13.0 percent : flour: Vol.: protein content ³ (Pct.)(cc.)			
Henry	9	66.7 .931	11.2	795	914	
Pilot	20	54.4 .893	12.6	852	874	
Hope x Tinstein Minn. 2776	9	49.4 .987	13.4	878	868	
Regent	15	44.1 .871	13.2	877	868	
Commercial grades	17	50.2 .957	13.1	871	864	
Cadet	19	45.3 .930	13.4	875	856	
Rival	15	58.7 .870	12.6	831	855	
Mida x Cadet M1831	11	50.8 .866	12.9	847	851	
Newthatch	19	44.6 .801	13.8	872	838	
Ceres	9	49.2 .962	13.1	839	835	
Thatcher	24	49.2 .892	13.3	873	832	
Pilot x Mida M1756	14	58.7 .894	12.3	785	825	
Mida	20	42.9 .767	13.1	815	812	

^{1/} Slope of the regression line or the cubic centimeter change in loaf volume for each one percent of protein.

^{2/} Correlation coefficients for loaf volume and flour protein content. All correlation coefficients are significant at the 1 percent level.

^{3/} Calculated from regression equation.

Table 10.—Average of the milling, baking and chemical properties of 14 wheats, the average of comparable samples of Thatcher, and of each variety as shown in percentage of Thatcher, with the varieties arranged in order of percentage for optimum loaf volume in 1947.

Variety or Cross	No. of Samples	Acre Yield	Test Wt.	Protein		Flour		Ab-sorp-tion	Mix-mum Time	Opti-mum Bro-mate	Method and volume			Average		Pearling Index	
				Wheat	Flour	Yield	Ash				No. 6	Aver. 3 best	Opti-mum	Weight of loaf	Crumb color	Grain-ture	value
Regent	15	26.8	58.4	13.9	13.2	73.3	.50	65	2.4	1.13	870	846	877	151	82	90	27.7
Thatcher	15	27.9	58.4	13.5	12.8	73.5	.50	65	2.5	.47	820	815	849	151	81	88	24.5
Percentage of Thatcher		96.1	100.0	103.0	103.1	99.7	100.0	100.0	96.0	240.0	106.1	103.8	103.3	100.0	101.2	102.3	113.1
N. 1556	9	28.4	59.6	14.2	13.3	72.1	.48	66	2.1	1.00	852	835	867	153	89	89	29.8
Thatcher	9	28.6	58.3	14.0	13.3	73.2	.48	65	2.3	.78	834	820	852	150	81	88	25.9
Percentage of Thatcher		99.3	102.2	101.4	100.0	98.5	100.0	101.5	91.3	128.2	102.2	101.8	101.8	102.0	109.9	101.1	115.1
Mini. 2776	9	31.3	60.3	14.3	13.4	73.0	.49	67	2.5	.67	851	843	878	153	89	88	28.7
Thatcher	9	26.2	58.5	13.6	12.9	73.4	.50	65	2.6	.56	843	839	866	151	82	89	24.0
Percentage of Thatcher		119.5	103.1	105.1	103.9	99.5	98.0	103.1	96.2	119.6	100.9	100.5	101.4	101.3	108.5	98.9	119.6
Cadet	19	26.4	56.7	14.1	13.4	72.6	.53	67	2.5	.80	856	843	875	153	86	90	25.3
Thatcher	19	27.5	58.1	13.9	13.2	73.4	.50	65	2.5	.53	841	832	866	151	81	88	25.3
Percentage of Thatcher		96.0	97.6	101.4	101.5	98.9	106.0	103.1	100.0	150.9	101.8	101.3	101.0	101.3	106.2	102.3	99.6
Newhatch	19	26.1	57.3	13.4	13.8	73.9	.53	65	2.4	.68	858	841	873	152	80	89	26.5
Thatcher	19	27.5	58.1	13.9	13.2	73.4	.50	65	2.5	.53	841	832	866	151	81	88	25.3
Percentage of Thatcher		94.9	98.6	103.6	104.5	100.7	106.0	100.0	96.0	128.3	102.0	101.1	100.8	100.7	98.8	101.1	104.7
Redmar	9	28.3	58.2	13.6	13.0	74.3	.49	65	2.3	.78	858	836	867	152	84	90	28.4
Thatcher	9	27.0	58.4	13.7	13.0	73.4	.49	66	2.6	.67	846	835	868	151	81	88	24.6
Percentage of Thatcher		104.8	99.7	99.3	100.0	101.2	100.0	98.5	88.5	116.4	101.4	100.1	99.9	100.7	103.7	102.3	115.4
Rescue	6	24.2	56.8	15.3	14.6	71.1	.47	64	2.2	1.17	905	884	911	150	79	89	29.4
Thatcher	6	27.1	57.3	15.2	14.6	72.2	.48	65	2.3	.50	905	881	915	151	82	89	26.4
Percentage of Thatcher		89.3	99.1	100.7	100.0	98.5	97.9	98.5	95.7	234.0	100.0	100.3	99.6	99.3	96.3	100.0	111.4
Pilot	19	27.4	57.5	13.7	12.6	72.0	.49	63	2.2	.47	828	815	853	151	82	87	24.5
Thatcher	19	27.5	58.1	13.9	13.2	73.4	.50	65	2.5	.53	841	832	866	151	81	88	25.3
Percentage of Thatcher		99.6	99.0	98.6	95.5	98.1	98.0	96.9	88.0	88.7	98.5	98.0	98.5	100.0	101.2	98.9	96.8
S.D. 2280	4	23.8	60.5	14.0	13.2	73.7	.51	64	2.4	.25	762	765	807	152	82	87	28.9
Thatcher	4	27.3	59.5	13.7	12.9	73.6	.51	65	2.3	.50	797	788	819	150	81	88	26.0
Percentage of Thatcher		105.5	101.7	102.2	102.3	100.1	100.0	98.5	104.3	50.0	95.6	97.1	98.5	101.3	101.2	96.9	111.2
Rival	15	29.8	59.5	13.6	12.6	75.0	.53	67	2.6	.40	791	783	832	153	83	87	26.8
Thatcher	15	27.9	58.4	13.5	12.8	73.5	.50	65	2.5	.47	820	815	849	151	81	88	24.5
Percentage of Thatcher		106.8	101.9	100.7	98.4	102.0	106.0	103.1	104.0	85.1	96.5	96.1	96.0	101.3	102.5	98.9	109.4
1831	11	28.9	58.7	13.6	12.9	74.2	.48	65	2.2	1.18	839	818	848	152	81	88	27.3
Thatcher	11	26.7	57.8	14.2	13.5	72.8	.50	65	2.3	.64	850	839	867	151	81	87	25.5
Percentage of Thatcher		108.2	101.6	95.8	95.6	101.9	96.0	100.0	95.7	184.3	98.7	97.5	97.8	100.7	100.0	101.1	107.1
Henry	8	32.3	58.8	12.2	11.1	74.8	.48	62	2.1	.50	775	757	791	152	70	82	32.4
Thatcher	8	27.8	58.4	13.1	12.4	73.9	.51	66	2.7	.25	810	801	838	151	81	87	23.9
Percentage of Thatcher		116.2	100.7	93.1	89.5	101.2	94.1	93.9	77.8	200.0	95.7	94.5	94.4	100.7	86.4	94.3	135.6
Mildred	19	29.2	60.4	13.9	13.0	75.2	.50	65	2.3	.68	795	781	816	153	86	87	29.1
Thatcher	19	27.5	58.1	13.9	13.2	73.4	.50	65	2.5	.53	841	832	866	151	81	88	25.3
Percentage of Thatcher		106.2	104.0	100.0	98.5	102.5	100.0	100.0	88.0	128.3	94.5	93.9	94.2	101.3	106.2	98.9	115.0
N. 1756	14	29.1	60.4	13.2	12.2	73.0	.45	64	2.2	.57	762	742	785	152	85	85	28.1
Thatcher	14	27.1	56.1	13.8	13.1	73.5	.50	65	2.4	.64	843	829	861	151	81	87	25.1
Percentage of Thatcher		107.4	104.0	95.7	93.1	99.3	90.0	98.5	91.7	89.1	90.4	89.5	91.2	100.7	104.9	97.7	112.0

Table 11.—Annual and total number of samples comparable with Thatcher and weighted average milling, baking, and chemical properties expressed in percentage of Thatcher for the 10 years, 1933 through 1947.

Variety State or Nursery No.	Crop year and number of samples										Total
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	
Thatcher	11	12	14	16	18	20	18	23	20	25	177
Pilot	8	11	14	13	14	14	16	19	20	19	148
Rival	8	9	9	13	11	12	10	11	14	15	112
Cadet	—	—	2	10	16	13	14	18	19	19	111
Mida	—	2	9	10	7	8	14	18	20	19	107
Newthatch	—	—	2	9	12	12	14	18	19	19	103
Regent	2	4	7	10	9	12	10	12	14	15	95
N. No. 1756	—	—	—	—	—	4	7	13	12	14	50
Henry	—	—	—	—	3	6	6	5	10	8	33
N. No. 1556	—	—	—	—	—	4	4	5	4	9	26
S. D. 2280	—	—	—	—	4	4	2	3	4	4	21
N. No. 1831	—	—	—	—	—	—	—	4	5	11	20
Rescue	—	—	—	—	—	—	—	5	7	6	18
Redman	—	—	—	—	—	—	—	—	9	9	18
Minn. 2776	—	—	—	—	—	—	—	—	6	9	15

Variety State or Nursery No.	Test weight per bushel										Total
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	
Mida	—	104.8	105.6	107.9	106.5	104.1	102.9	106.2	103.2	104.0	104.7
N. No. 1756	—	—	—	—	—	105.5	104.1	105.1	103.9	104.0	104.4
Minn. 2776	—	—	—	—	—	—	—	—	103.1	103.1	103.1
S. D. 2280	—	—	—	—	101.4	103.6	103.1	104.7	102.9	101.7	102.8
Rival	105.1	100.7	100.2	103.6	102.6	101.0	100.3	105.4	100.8	101.9	102.1
Henry	—	—	—	—	102.4	103.0	101.4	104.7	101.2	100.7	101.9
N. No. 1831	—	—	—	—	—	—	—	103.9	99.8	101.6	101.6
N. No. 1556	—	—	—	—	—	101.4	100.7	101.7	100.0	102.2	101.4
Regent	101.5	97.0	98.6	102.6	102.3	100.9	99.3	100.9	99.2	100.0	100.3
Pilot	100.9	100.0	100.5	102.3	101.6	100.2	100.0	100.9	99.3	99.0	100.2
Rescue	—	—	—	—	—	—	—	102.5	99.7	99.1	100.2
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Redman	—	—	—	—	—	—	—	—	99.2	99.7	99.5
Cadet	—	—	98.8	100.4	101.0	98.5	99.7	99.5	98.5	97.6	99.2
Newthatch	—	—	99.8	101.3	101.0	98.5	99.3	98.9	98.5	98.6	99.2

Variety State or Nursery No.	Crude protein content of the wheat										Total
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	
Minn. 2776	—	—	—	—	—	—	—	—	106.3	105.1	105.6
Newthatch	—	—	102.4	108.9	107.2	106.1	104.4	104.9	104.8	103.6	105.2
Regent	106.0	103.1	102.5	106.8	106.1	104.7	104.6	101.5	103.5	103.0	103.9
S. D. 2280	—	—	—	—	104.8	101.9	100.7	103.0	103.7	102.2	102.9
Cadet	—	—	100.0	104.8	104.9	103.6	101.5	101.4	99.3	101.4	102.1
N. 1556	—	—	—	—	—	102.0	101.5	103.5	102.9	101.4	102.1
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mida	—	97.6	95.6	102.0	102.1	107.6	98.5	96.5	100.0	100.0	99.7
Rival	100.0	94.2	97.3	100.7	100.7	101.3	100.8	98.6	100.7	100.7	99.7
Redman	—	—	—	—	—	—	—	—	100.0	99.3	99.7
Pilot	102.0	94.2	100.0	100.7	98.6	99.3	97.0	97.2	97.9	98.6	98.3
Rescue	—	—	—	—	—	—	—	97.0	96.1	100.7	97.9
N. No. 1831	—	—	—	—	—	—	—	94.6	95.2	95.8	95.4
N. No. 1756	—	—	—	—	—	97.3	94.3	94.4	93.6	95.7	94.8
Henry	—	—	—	—	97.8	95.3	92.6	93.9	92.2	93.1	93.6

Variety State or Nursery No.	Yield of Flour										
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Total
Rival	105.5	102.7	99.4	103.1	101.2	103.4	101.9	104.4	102.4	102.0	102.5
Henry					102.8	102.5	102.4	104.4	102.3	101.2	102.4
Mida		100.7	102.3	102.5	102.7	101.9	102.1	103.8	101.9	102.5	102.4
N. No. 1831								105.2	100.7	101.9	102.3
S. D. 2280					101.7	101.7	101.0	105.6	102.7	100.1	102.0
Newthatch			102.5	100.9	101.7	101.4	101.2	101.3	100.1	100.7	101.0
Redman									100.1	101.2	100.7
N. No. 1756						99.6	99.9	102.1	100.4	99.3	100.4
Regent	100.9	98.4	100.0	100.9	99.7	102.3	99.5	100.8	98.9	99.7	100.2
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Minn. 2776									100.1	99.5	99.7
Cadet			99.3	99.6	100.0	100.3	99.2	99.2	98.4	98.9	99.3
N. No. 1556						98.5	99.3	100.1	98.5	98.5	99.0
Rescue								100.6	97.7	98.5	98.8
Pilot	98.5	99.3	98.2	99.4	99.9	99.7	98.1	99.3	97.7	98.1	98.1

Variety State or Nursery No.	Ash in Flour										
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Total
Cadet			123.9	113.5	105.7	107.1	100.0	102.1	104.2	106.0	105.3
Newthatch			126.1	111.5	101.9	107.1	102.0	104.3	104.2	106.0	105.2
Rival	96.1	104.0	107.5	105.8	98.1	109.1	101.9	106.5	106.3	106.0	104.4
Regent	104.0	111.3	115.4	103.8	92.3	100.0	98.1	100.0	98.0	100.0	100.8
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Redman									100.0	100.0	100.0
Minn. 2776									98.0	98.0	98.0
N. No. 1556						101.9	96.1	89.4	100.0	100.0	97.6
Mida		85.5	100.0	105.9	92.3	94.7	96.1	93.6	98.0	100.0	97.4
Pilot	100.0	98.0	100.0	101.9	96.2	98.1	90.0	95.7	93.8	98.0	96.7
S. D. 2280					101.7	93.1	90.0	91.5	98.0	100.0	96.4
Rescue								94.0	93.6	97.9	95.1
N. No. 1831								90.2	91.5	96.0	93.7
Henry					87.7	93.1	90.6	93.8	96.0	94.1	93.3
N. No. 1756						100.0	86.0	87.5	88.0	90.0	89.1

Variety State or Nursery No.	Water Absorption of Flour										
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Total
Cadet			109.2	104.8	106.7	104.2	104.7	104.8	103.1	103.1	104.5
Rival	103.9	100.5	102.2	103.2	105.0	102.7	101.6	104.8	103.1	103.1	103.1
Minn. 2776									103.1	103.1	103.1
N. No. 1556						101.6	101.7	103.1	103.1	101.5	102.1
N. No. 1831								101.6	101.5	100.0	100.7
Newthatch			104.6	101.1	102.1	100.6	100.0	101.6	100.0	100.0	100.6
Regent	100.7	99.1	100.5	101.6	101.6	99.4	98.4	101.6	101.6	100.0	100.6
S. D. 2280					100.0	103.3	103.1	98.4	100.0	98.5	100.4
Mida		97.3	99.8	98.4	101.6	100.5	100.0	101.6	100.0	100.0	100.2
Redman									101.6	98.5	100.1
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pilot	97.8	98.9	100.5	100.0	100.0	98.5	98.4	100.0	98.5	96.9	98.9
N. No. 1756						98.4	98.4	100.0	98.4	98.5	98.9
Rescue								98.4	98.5	98.5	98.5
Henry					100.0	99.3	98.4	100.0	98.4	93.9	97.9

Table 11.--Continued

Variety State or Nursery No.	Loaf Volume, Method No. 6										
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Total
Regent	109.8	100.1	99.9	105.0	103.6	95.0	105.6	102.8	107.4	106.1	103.4
Newthatch	---	---	97.4	103.7	103.3	99.4	103.4	101.6	103.4	102.0	102.2
Rescue	---	---	---	---	---	---	---	103.1	102.8	100.0	101.9
Minn. 2776	---	---	---	---	---	---	---	---	102.7	100.9	101.6
Redman	---	---	---	---	---	---	---	---	100.6	101.4	101.0
Cadet	---	---	97.9	102.2	100.5	97.1	103.0	100.1	102.2	101.8	100.9
S. D. 2280	---	---	---	---	104.8	98.6	94.1	101.5	104.0	95.6	100.2
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pilot	97.3	95.8	98.0	99.6	100.1	100.6	98.9	101.6	98.6	98.5	99.3
N. No. 1831	---	---	---	---	---	---	---	98.9	99.8	98.7	99.1
Rival	95.4	94.2	90.3	97.1	101.7	99.6	106.8	99.0	103.2	96.5	90.7
N. 1556	---	---	---	---	---	85.3	99.9	98.8	103.2	102.2	98.7
Henry	---	---	---	---	99.2	90.8	96.7	99.5	97.4	95.7	96.3
Mida	---	87.7	88.8	91.5	98.4	98.6	98.8	96.7	97.7	94.5	95.7
N. No. 1756	---	---	---	---	---	90.4	96.0	95.5	91.1	90.4	93.0

Variety State or Nursery No.	Loaf Volume, Average										
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Total
Regent	101.6	98.6	99.8	102.8	101.9	94.4	106.0	104.0	106.7	103.8	102.4
Minn. 2776	---	---	---	---	---	---	---	---	102.0	100.5	102.3
Newthatch	---	---	97.8	102.2	102.6	99.8	101.6	101.6	103.9	101.1	101.8
Rescue	---	---	---	---	---	---	---	100.5	101.5	100.3	100.8
Cadet	---	---	97.7	100.2	98.4	94.9	104.1	102.5	101.9	100.6	101.3
Redman	---	---	---	---	---	---	---	---	100.6	100.1	100.4
N. No. 1556	---	---	---	---	---	85.0	101.7	104.6	104.3	101.8	100.2
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pilot	102.7	97.3	99.0	100.1	103.0	103.4	97.3	100.2	99.4	98.0	99.8
S. D. 2280	---	---	---	---	104.4	96.7	96.5	99.6	101.4	97.1	99.5
N. No. 1831	---	---	---	---	---	---	---	101.7	99.3	97.5	98.8
Rival	99.0	94.0	91.0	95.9	101.0	100.0	104.1	99.4	102.4	96.1	98.4
Henry	---	---	---	---	96.5	89.5	97.6	99.2	97.9	94.5	95.8
Mida	---	91.5	89.2	91.9	98.6	98.8	96.4	95.6	96.9	93.9	95.1
N. No. 1756	---	---	---	---	---	92.5	94.2	94.6	91.1	89.5	92.1

Variety State or Nursery No.	Loaf Volume, Optimum										
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Total
Regent	106.6	99.7	100.5	104.9	103.1	95.3	105.9	103.4	106.8	103.3	102.9
Minn. 2776	---	---	---	---	---	---	---	---	102.4	101.4	101.8
Newthatch	---	---	97.4	103.4	103.0	99.9	101.6	100.9	101.6	100.8	101.3
Rescue	---	---	---	---	---	---	---	101.0	103.1	99.6	101.3
Redman	---	---	---	---	---	---	---	---	101.9	99.9	100.9
Cadet	---	---	97.9	101.5	100.0	97.2	104.1	101.5	102.3	101.0	100.8
S. D. 2280	---	---	---	---	104.7	98.9	97.2	101.6	102.5	98.5	100.8
N. No. 1556	---	---	---	---	---	85.3	102.3	104.3	105.9	101.8	100.4
Pilot	99.3	96.0	98.5	100.0	101.4	100.6	97.8	100.3	101.0	98.5	100.2
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N. No. 1831	---	---	---	---	---	---	---	100.7	100.2	97.8	99.0
Rival	97.3	93.9	92.1	96.6	101.2	99.8	104.2	98.6	102.3	98.0	98.7
Henry	---	---	---	---	98.9	90.8	97.8	97.7	97.7	94.4	96.0
Mida	---	88.4	89.0	91.4	98.2	98.6	96.4	96.3	97.1	94.2	95.2
N. No. 1756	---	---	---	---	---	90.4	94.9	95.2	91.8	91.2	92.9

Variety State or Nursery No.	Crumb Color, Average										
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Total
Minn. 2776									113.4	108.5	110.5
Mida		108.8	103.6	111.1	107.0	108.4	105.9	108.1	102.5	106.2	107.3
N. No. 1756						108.6	107.2	108.4	104.8	104.9	106.4
Cadet			101.1	111.1	105.8	100.0	105.9	107.4	109.8	106.2	106.4
N. No. 1556						97.5	102.4	108.4	106.1	109.9	105.9
Redman									107.4	103.7	105.6
Pilot	109.5	101.7	100.1	103.6	105.8	106.0	103.5	104.8	103.7	101.2	103.7
Rival	108.9	98.2	96.4	103.6	105.8	104.8	104.7	104.9	103.7	102.5	103.4
S. D. 2280					103.4	102.5	97.7	97.8	102.6	101.2	102.4
N. No. 1831								102.5	100.0	100.0	100.5
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Regent	97.5	95.7	97.7	103.7	103.5	92.8	102.4	100.0	100.0	101.2	99.9
Newthatch			94.3	107.6	100.0	96.4	98.8	98.2	101.2	98.8	99.5
Rescue								97.5	96.3	96.3	96.6
Henry					90.0	91.5	89.8	96.8	93.8	86.4	91.4

Variety State or Nursery No.	Grain Texture, Average										
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Total
S.D. 2280					102.2	104.9	102.2	101.1	104.6	98.9	102.4
Cadet			94.4	102.3	101.1	97.6	104.7	102.1	103.5	102.3	101.9
Pilot	104.6	99.9	97.0	101.2	102.3	103.6	102.3	101.1	101.2	98.9	101.1
Minn. 2776									104.5	98.9	101.1
N. No. 1756						104.8	102.3	101.8	102.3	97.7	101.0
Mida		103.4	97.8	101.1	101.1	104.7	101.2	101.3	103.5	98.9	101.0
Newthatch			96.6	100.0	101.1	100.0	101.2	100.0	102.3	101.1	100.9
N. No. 1831								101.1	98.9	101.1	100.6
Redman									92.9	102.3	100.6
Rival	99.3	99.0	94.3	101.2	101.1	103.6	102.3	101.6	102.3	98.9	100.5
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Rescue								101.2	98.9	100.0	99.9
N. No. 1556						92.9	98.9	101.1	102.3	101.1	99.8
Regent	95.9	93.5	93.3	98.9	100.0	96.4	102.3	98.9	102.3	102.3	99.4
Henry					98.8	96.4	96.4	96.6	98.8	94.3	96.8

Variety State or Nursery No.	Summary of all tests for seven properties							
	Test Weight	Wheat Protein	Flour Yield	Absorption	Opt. Volume	Crumb color	Grain Texture	Average 7 Properties
Minn. 2776	103.1	105.6	99.7	103.1	101.8	110.5	101.1	103.5
Cadet	99.2	102.1	99.3	104.5	100.8	106.4	101.9	102.0
S. D. 2280	102.8	102.9	102.0	100.4	100.8	102.4	102.4	101.9
N. No. 1556	101.4	102.1	99.0	102.1	100.4	105.9	99.8	101.5
Mida	104.7	99.7	102.4	100.2	95.2	107.3	101.0	101.5
Rival	102.1	99.7	102.5	103.1	98.7	103.4	100.5	101.4
Newthatch	99.2	105.2	101.0	100.6	101.3	99.5	100.9	101.1
Redman	99.5	99.7	100.7	100.1	100.9	105.6	100.6	101.0
Regent	100.3	103.9	100.2	100.6	102.9	99.9	99.4	101.0
Pilot	100.2	98.3	98.1	98.9	100.2	103.7	101.1	100.1
N. No. 1831	101.6	95.4	102.3	100.7	99.0	100.5	100.6	100.0
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N. No. 1756	104.4	94.8	100.4	98.9	92.9	106.4	101.0	99.8
Rescue	100.2	97.9	98.8	98.5	101.3	96.6	99.9	99.0
Henry	101.9	93.6	102.4	97.9	96.0	91.4	96.8	97.1

It is of interest to note that Henry, Pilot, Hope x Tinstein (Minn. 2776) and Regent are highest in loaf volume (converted to 13.0 percent protein level) exceeding the commercial samples as well as Thatcher in this respect. Henry and Pilot were also among the higher varieties for the last 2 years. Pilot x Mida M1756 and Mida were lowest, by the same comparisons and similar in this respect to last year's results, due in part to their high yield.

Protein strength or protein quality is by no means the only measure of the suitability of a wheat variety or strain for bread baking purposes. Loaf volume is probably, however, the most important in relation to bread baking. Other flour properties considered important are mixing time, water absorption, oxidation, bread grain texture and crumb color. These quality factors are considered in other tables.

SUMMARY: COMPARABLE SAMPLES 1947

In table 10, the properties of the 1947 samples of 14 varieties or strains of hard red spring wheat are compared with those of Thatcher grown in the same tests. The varieties are arranged in order of the optimum loaf volume expressed as a percentage of Thatcher.

SUMMARY: COMPARABLE SAMPLES 1938 TO 1947

Table 11 gives the averages (2 to 10 years) of the milling, baking, and chemical properties of 15 varieties and strains, expressed as a percentage of comparable samples of Thatcher. These include the leading commercial varieties grown in the region and the most promising new hybrid strains that have been tested. The total number of samples tested of each variety or strain varied from 15 to 177. The more important quality comparisons shown in the summary table 11 will be discussed in relation to Thatcher as 100 percent.

THATCHER

Thatcher has been a uniform variety in the plot experiments since 1932. It was distributed for commercial growing in 1934. It is resistant to stem rust, is early, has short, strong straw and yields well. Its commercial acreage increased rapidly until it became the most widely grown variety in 1933. It probably reached its peak in 1941 when it was grown on about 6 million acres in the United States and 9 or 10 million acres in Canada. Being susceptible to leaf rust, it was injured severely in 1938, 1939, and again in 1941 and its acreage has since decreased in the United States giving way to Rival and Pilot and later to other varieties in the leaf-rust-affected sections. Thatcher replaced Marquis as a standard of comparison in these studies in 1939, and as it is still a widely grown variety, it is here used as the standard of comparison for the different milling and baking properties.

These tests show Thatcher to average about medium in test weight being exceeded by a number of the commercially acceptable varieties. It has shown excellent milling qualities producing a high percentage of flour and somewhat better than would be expected from its test weight. The protein content is medium to high and the flour ash about average as compared with the flour ash from a number of other commercially grown varieties. The

quality of the protein is excellent. Thatcher has excellent baking qualities in experimental baking tests and is preferred by the grain trade for a strong type bakers' flour.

The dough characteristics of the Thatcher flour frequently tend to be "bucky" and is not as soft and pliable as the dough made from Marquis. Thatcher required a medium to long dough mixing time and medium amounts of oxidizing agents for optimum bread. The grain of Thatcher is medium hard according to the pearling index values. It ranks high in loaf volume of bread, has good grain-texture, satisfactory but only medium crumb color and a reasonably high water absorption.

PILOT

Pilot has been a uniform variety in plot experiments since 1936 and commercially grown since 1939. It has shown excellent milling and baking qualities in experimental baking tests and is approved by the grain trade for a strong type flour. Pilot is resistant to stem rust, to mildew, bunt and some of the footrots. This variety was seeded in an estimated 1-1/4 million acres in 1944 and has continued to increase in the western section of the spring wheat area.

It has been one of the highest in yield of the uniform varieties during the past 10 years; ranking first for the region in five of the years. It ranked fifth in quality in the Eastern composite and third in the Western composite during the 4 year period 1944 to 1947 inclusive as shown in table 2. The weighted average of 148 comparable samples for 10 years shows Pilot exceeds Thatcher with respect to test weight, optimum loaf volume, crumb color and grain-texture of bread. Pilot has made bread, during the last ten seasons, that has averaged considerably better than Thatcher in crumb color, and except for 3 years, much better than Thatcher in grain-texture.

It has been uniformly low in flour ash content and exceeded many of the uniform varieties in this respect. The quality of the protein is good. Pilot averages lower in wheat protein content than Thatcher, but is equal to Thatcher in optimum loaf volume of bread for the average of 10 years' tests. Pilot has a short dough mixing time. It averages slightly lower than Thatcher for the other properties. While the pearling index for Pilot is low, indicating hard texture, it mills satisfactory. The flour yield however averages slightly less than Thatcher. In supplemental baking tests Pilot does not usually respond to increasing amounts of bromate and is easily injured by long fermentation. The dough properties of Pilot are elastic and pliable as contrasted with some varieties which produce "bucky" doughs.

RIVAL

Rival was made a uniform variety in 1938 and together with Pilot was distributed for commercial growing in 1939. By 1944 they had increased to six million acres, with Rival exceeding Pilot about 3 to 1. Rival has shown good milling and baking qualities in experimental baking tests and is considered satisfactory by the grain trade. It has a somewhat higher pearling index value suggesting that the grain is slightly softer than the grain from Thatcher. Both Pilot and Rival are awned wheats and do not have as strong straw as desired for the heavier soils in the eastern section.

Rival shatters worse than Pilot and is not adapted to the western section. Among the uniform varieties Rival has yielded less than Mida but more than Pilot and Thatcher during the past 4 years for the eastern section.

The weighted average of 112 comparable samples for 10 years show Rival to exceed Thatcher with respect to test weight, flour yield, water absorption, crumb color and grain-texture of bread. It is only slightly lower in protein than Thatcher. It is one of the better varieties in water absorption being exceeded only by Cadet of 15 varieties compared. Rival has a slightly longer dough mixing time and requires slightly higher amounts of oxidizing agents than Thatcher for optimum bread. It is among the varieties high in flour ash. It averages higher than Thatcher but is lower than Cadet and Newthatch in this respect. It has been outstanding as to yield of flour ranking better than most of the varieties and strains grown over a period of years. Of 15 wheats shown in table 11, it ranks 12th in optimum loaf volume and 6th for the average of seven principal properties.

CADET

Cadet has been a uniform variety for the region for the 6 years 1942 to 1947. It is the result of a Morit x Thatcher cross and was increased in 1944 and distributed for commercial growing in 1945. Cadet is a midseason, awnleted wheat resistant to stem rust. It has been a high yielding wheat for the region but appears best adapted to the northern part. During an 8-year period 111 comparable milling and baking tests show it to exceed Thatcher with respect to crude protein content of wheat, water absorption, loaf volume for the optimum bake, crumb color, and grain texture. The bread has been outstanding in crumb color and grain-texture ranking among the better varieties and strains grown over a period of years. It averaged highest in water absorption and ash content of flour of the varieties and strains tested for 8 years. Cadet mills satisfactorily and is similar to Thatcher in hardness, according to the pearling index values. It has about the same dough mixing time and requires slightly higher amounts of oxidizing agents than Thatcher for optimum bread. Supplemental baking tests show that it responds sharply to increasing amounts of bromate and generally has greater tolerance to long periods of mixing and fermentation than most varieties. It has ranked high by the baking methods used by the North Dakota and Canadian laboratories. Commercial milling and baking tests for the last 5 years rank it high in quality. It is nearly equal to Thatcher in test weight and flour yield. Among the 15 wheats, (table 11) it ranks fifth in crude protein of wheat, first in water absorption, sixth in loaf volume by the optimum bake, fourth in crumb color, and second in grain-texture, and for the average of seven principal properties.

MIDA

Mida was first made a uniform variety for the region in 1944 when it was distributed for commercial growing by the North Dakota Agricultural Experiment Station. It has been in plot experiments at the North Dakota and Minnesota stations for 8 years. It was the highest yielding wheat for the region during the years tested. It is an awned, strong strawed wheat, heavy test weight wheat, resistant to stem rust and to bunt. It is susceptible to loose smut and to shattering. Mida mills fair to good producing a high yield of flour. The grain is slightly softer than that from Thatcher

according to the pearling index values and the milling tests. During 9 years, 107 milling and baking tests show that it exceeds Thatcher with respect to test weight, flour yield, water absorption, crumb color, and grain-texture of bread and has a lower wheat protein and ash content of the flour. It has been outstanding in crumb color, ranking highest among the varieties and strains tested for 9 years. In loaf volume Mida ranked lower than Thatcher by the optimum bake. Mida has a slightly shorter dough mixing time and requires about the same amount of oxidizing agents as Thatcher for optimum bread. It ranked 13th in loaf volume according to the optimum bake, first in crumb color, and sixth in grain texture (same as Pilot) among 15 wheats. It averaged first in test weight per bushel, third in flour yield, and fifth for the summary of seven principal properties. It had the lowest loaf volume figured in a 13.0 percent protein basis of the 15 wheats compared in 1947.

REGENT

Regent has been a uniform variety since 1942. It was developed and distributed by the Canadian Department of Agriculture in 1939 and has been grown commercially in the United States since 1940. It is recommended for growing on the heavier soils of the Red River Valley of Minnesota and North Dakota. In other areas, however, it has been damaged by high temperatures and scab, and has not been a high yielding wheat. It ranked fifth in 1945, seventh in 1946, and sixth in 1947 of the seven uniform varieties for the eastern stations. It has shown excellent milling and baking qualities in experimental tests and has been approved by the commercial grain trade. Ninety-five comparable tests with Thatcher covering 10 years show it to exceed Thatcher with respect to test weight, crude protein of wheat, flour yield, water absorption and loaf volume for the optimum bake, but lower in other properties. It is higher in ash of flour than Thatcher. The grain of Regent is found to be somewhat softer than that of Thatcher according to the pearling index values. Regent has about the same dough mixing time but requires considerably higher amounts of oxidizing agents than Thatcher for optimum bread. Regent has been particularly high in protein exceeding many of the wheats with which it has been comparably grown. This is in part due to its relatively low acre yields. However, it has been consistently higher in protein on a yearly basis in comparison with the varieties grown for a 10-year period. The better loaf volume obtained from Regent indicates that the quality of the protein also is good. Regent averages ninth in the summary of seven principal properties.

NEWTATCH

Newthatch is composite of several Hope x Thatcher³ backcross strains, one of which was a uniform variety for the eastern section in 1942. In 1943 Newthatch replaced a single line as a uniform variety for the eastern section and was made a uniform variety for the region in 1944. The variety was distributed to seed growers by the Minnesota Agricultural Experiment Station in 1944. It had shown greater leaf rust resistance than Thatcher and had been one of the better yielding wheats in the Minnesota plots, averaging over a period of years the same as Rival. In recent years Newthatch has not been as resistant to leaf rust or high in yield for the region, exceeding only Thatcher among the five uniform varieties.

By using yields and milling and baking data for the single lines included in the composite, data are available for an 8-year period. During

this period, 103 comparable milling and baking tests have been completed in which Newthatch has exceeded Thatcher with respect to crude protein of wheat, flour yield, water absorption, and loaf volume by the optimum bake and grain-texture. It was high in ash content, ranking second in comparison with 15 wheats. It has one outstanding advantage in being highest in protein content of the wheats compared for 8 years. Only the new strain Hope x Tinstein Minn. 2776, (2 years' tests) has been shown to be higher in protein content. Newthatch has a slightly lower test weight than Thatcher but has yielded slightly more flour than Thatcher during each of the 8 years compared. Newthatch has shown good milling quality in our experimental tests and is also considered satisfactory by the grain trade. The grain of Newthatch is slightly softer than Thatcher according to the pearling index values. In loaf volume, Newthatch ranks higher than Thatcher by the optimum bake. Newthatch has about the same dough mixing time, but requires slightly more bromate than Thatcher for optimum volume.

HENRY

Henry was the highest yielding wheat in the uniform regional nursery for the 3-year period 1942 to 1944, and was increased and distributed by the Wisconsin Agricultural Experiment Station in 1944. It has also been a high-yielding wheat in Wisconsin experiments and has been tested at Minnesota, North Dakota, and South Dakota stations with favorable yield results. It was the highest yielding variety of the 15 wheats compared in 1947 and considerably exceeds Thatcher in this respect. During 6 years, 38 milling and baking tests show that it exceeds Thatcher with respect to test weight, flour yield, and has one of the lowest ash content of the 15 wheats. Although not the highest in test weight, it yields more flour than any of the wheats with which it was compared. Henry has good milling characteristics. It has the highest pearling index value of the wheats compared indicative of a soft textured grain. The flour is soft and does not have the granular characteristics of hard wheats, for which reason it is not acceptable to the grain trade. It is one of the lowest in protein of the 15 wheats compared. The quality of the protein is very good, producing bread that has an optimum loaf volume nearly as good as some of the much higher protein varieties. It ranks lower than Thatcher in water absorption, and loaf volume by the optimum bake. It had a shorter mixing time and required much larger amounts of bromate than Thatcher for optimum bread. Henry is easily injured by long mixing but appears to have good fermentation tolerance. The dough characteristics are somewhat softer than found in most of the hard red spring wheats. It ranks lowest in crumb color, protein content, grain-texture of bread and the average of seven principal properties of the 15 wheats compared. Henry had the highest loaf volume figured on a 13.0 percent protein basis of the wheats compared.

S. D. 2280

S. D. 2280 is a beardless selection from a Rival x Thatcher cross, developed at the South Dakota Agricultural Experiment Station. It was tested in the Uniform Regional Nursery for the 3 years, 1942 to 1944. It has been in plot experiments at Brookings for a 6-year period; for a single year (1946) at Newell, S. Dak., at three North Dakota stations in 1947 (Fargo, Edgeley and Mandan), and at Sheridan, Wyo. in 1947. S. D. 2280 is a stiff strawed, early strain which has yielded well in South Dakota experiments. During 6 years, 21 milling and baking tests show that S. D. 2280 exceeds Thatcher with respect to test weight per bushel, protein of wheat,

yield of flour, water absorption, loaf volume of optimum bake, crumb color, and grain-texture of bread. It ranks lower than Thatcher in flour ash and is one of the better varieties in this respect. It has produced bread having especially good grain-texture. S. D. 2280 has averaged high in protein of the 15 varieties compared. It has a high pearling index value in comparison with the other wheats indicative of a soft textured grain, but appears to have good milling characteristics. The dough mixing time is slightly longer than required for Thatcher. It does not respond to increasing amounts of bromate, requiring approximately one-third the amount needed for Thatcher for optimum results. These few tests show that it has made exceptionally good grain-texture of the bread and has ranked highest in the last 3 years' tests among the wheats compared. It ranked fourth in wheat protein, fifth in flour yield, seventh in loaf volume of optimum bake and third in the summary of seven principal properties. S. D. 2280 is a fair yielding, early wheat which has proved to be of high quality and is one of the more promising strains tested during the last few years. Correlation coefficients have not been calculated because of the small number of samples and consequently, no attempt to evaluate loaf volume on a 13.0 percent protein basis has been made.

N. NO. 1556

N. No. 1556 is an early bearded selection from a Ceres x Hope-Turkey-Florence cross developed at the Dickinson Substation, Dickinson, N. Dak. It was included in the Uniform Regional Nursery for the 3 years 1943 to 1945, where it was the earliest variety in the experiment for three consecutive years. It has been in plot experiments at Dickinson for 6 years and at other North Dakota stations and at some of the more southern stations for shorter periods. Because of its earliness, it has yielded best at the more southern stations, particularly in Nebraska. During the 5 years (1943 to 1947) 26 milling and baking tests show that N. No. 1556 exceeds Thatcher with respect to test weight, protein of wheat, water absorption of flour, loaf volume of bread by the optimum method, and crumb color of bread. It is lower than Thatcher with respect to flour ash and yield of flour and has good milling characteristics. It has about the same pearling index value as Thatcher, indicating that the grain of both are alike in hardness. N. No. 1556 averaged slightly shorter than Thatcher in dough mixing time. It responds well to increasing amounts of bromate, requiring for optimum results, about twice the amount needed for Thatcher. It ranks fourth among 15 varieties for an average of seven principal properties. Correlation coefficients have not been calculated because of the small number of samples, and consequently, no attempt has been made to evaluate it on a 13.0 percent protein basis.

N. NO. 1756

N. No. 1746 is Pilot x Mida (C.I. 12303) and was the highest yielding wheat in the Uniform Regional Nursery for the 3 years, 1943 to 1945. It has been advanced to plot tests at a large number of stations because of high yield and heavy test weight. In the plot experiments it has also been high yielding, exceeding all of the uniform varieties. It is bearded with good straw, does not shatter, bleach or sprout and is moderately resistant to the rusts and smuts.

During the last 5 years, 50 comparable milling and baking tests show it exceeds Thatcher in test weight, flour yield, crumb color, and grain-texture. It is outstanding in crumb color ranking third and in test weight ranking second among 15 wheats. It also has the lowest flour ash of the 15 varieties compared. N. No. 1756 has good milling characteristics, with better than average yields. It has a slightly higher pearling index value suggesting that the grain of N. No. 1756 is slightly softer than that of Thatcher. It averages lower in protein content and loaf volume than Thatcher, the latter probably being due in part to higher yields. It ranks next to lowest in protein content and lowest in optimum loaf volume among the 15 wheats compared. It had a slightly shorter dough mixing time but required about the same amount of oxidizing agents as Thatcher for optimum bread. The loaf volume on a 13.0 percent protein basis is low, but exceeded Mida among the 13 varieties included in this comparison, (table 9).

RESCUE

Rescue is a sawfly resistant variety developed at the Swift Current, Saskatchewan, Canada station. Because of sawfly damage in Montana it has been increased rapidly for growing there. Outside of the Montana sawfly area it is a relatively low yielding wheat, susceptible to leaf rust, drought, mildew and has weak straw. During the last 3 years 18 milling and baking tests show that Rescue exceeds Thatcher with respect to test weight and loaf volume of bread by the optimum bake. It averaged lower than Thatcher for absorption and all the other properties, ranking twelfth among the 15 wheats compared in wheat protein and next to lowest in crumb color. The loaf volume of the bread was high for the low percent of protein found in Rescue. This suggests that the quality of the protein in Rescue is good. It handles satisfactorily in the mill producing a flour similar to Thatcher in granulation. It is one of the better varieties in loaf volume (optimum bake) ranking fourth among 15 wheats. Rescue had about the same dough mixing time but required about one-third less amounts of oxidizing agents than Thatcher for optimum bread. It ranks 14th in the summary of seven principal properties. Correlation coefficients were not calculated because of the small number of samples.

N. NO. 1831

N. No. 1831 is Mida x Cadet (C. I. 12363). It has been in the Uniform Regional Nursery for 3 years 1945 to 1947, ranking first for yield of the wheats grown during that period. It had the highest average optimum loaf volume for the Eastern and Western composites in 1945, but with its high yield ranked lower for volume in 1946 and 1947. Because of the high yield and quality it was grown in plots at three stations in 1946 and at nine stations in 1947. During the three last years, 20 milling and baking tests show N. No. 1831 to exceed Thatcher in test weight, flour yield, water absorption, loaf volume of optimum bake, crumb color, and grain-texture. Due partly to its high yield, it averaged lower in wheat protein than Thatcher. It is one of the lowest in flour ash ranking 13th of the 15 wheats compared. N. No. 1831 has good milling characteristics and produced a granular flour similar in this respect to the flour from Thatcher. It averaged about the same as Thatcher in dough mixing time. It required about twice the amount of oxidizing agents as Thatcher for optimum bread. N. No. 1831 ranked 11th in the summary of seven principal properties.

REDMAN

Redman, R. L. 1834.1 was developed from a Regent x Canus cross at the Dominion Laboratory of Cereal Breeding, Winnipeg, Manitoba, Canada. It was distributed to Canadian wheat growers in 1945 and in the United States in 1946. It was first included in the Uniform Regional Nursery in 1946 where it ranked 23rd for yield among the 26 wheats. In 1947 it was also grown in plots at four North Dakota and three Minnesota stations. The average of 18 comparable samples for 2 years shows Redman exceeds Thatcher with respect to flour yield, water absorption of flour, loaf volume of optimum bake, crumb color and grain-texture. It averages lower than Thatcher in test weight and protein content but is equal to Thatcher in flour ash. It is outstanding in crumb color ranking sixth of the 15 wheats compared. It has a higher pearling index value, suggesting that the grain is slightly softer than that of Thatcher. Redman has good milling characteristics. It has about the same dough mixing time but needs a larger amount of oxidizing agents than Thatcher for optimum bread. It ranks eighth in the summary of seven principal properties. No correlation coefficients or regression lines were calculated because of the small number of samples tested.

MINN. 2776

Minn. 2776 is Hope x Tinstein II-39-46 (C. I. 12488). It has been in the Uniform Regional Nursery for the last 2 years ranking third for yield. It was also grown at four Minnesota stations in 1946 and three North Dakota and four Minnesota stations in 1947. During the last 2 years, 15 comparable milling and baking tests show it exceeds Thatcher in test weight, crude protein of wheat, water absorption, loaf volume of bread by the optimum bake, crumb color and grain-texture. It yields a low percentage of flour in relation to its high test weight and also when considered in relation with the test weights of some of the commercially accepted wheats. Minn. 2776 has good milling characteristics. The grain is somewhat softer than that of Thatcher according to the pearling index values. It was medium low in ash content, ranking 7th in comparison with 15 wheats. Minn. 2776 ranked first in 1946 and 1947 in protein content being slightly higher than Newthatch in this respect. Another outstanding advantage of Minn. 2776 is its superior crumb color of bread. It has ranked first for the 2 years' tests in comparison with 15 wheats. In water absorption of flour, it ranks high (same as Rival) and is exceeded only by Cadet. Minn. 2776 has about the same dough mixing time but requires slightly more bromate than Thatcher for optimum bread. It ranks first for the average of seven principal properties. It was third in loaf volume figured on a 13.0 percent protein basis of the wheats compared in 1947.